सत्यमेव जयते

THE INDIAN ASTRONOMICAL EPHEMERIS

FOR THE YEAR

2019

POSITIONAL ASTRONOMY CENTRE
INDIA METEOROLOGICAL DEPARTMENT
MINISTRY OF EARTH SCIENCES

PUBLISHED BY THE CONTROLLER OF PUBLICATIONS, CIVIL LINES, DELHI

PDGM . 69 . 2019
160-2018 (DSK - III)

THE

INDIAN

ASTRONOMICAL EPHEMERIS

FOR THE YEAR

2019

POSITIONAL ASTRONOMY CENTRE

INDIA METEOROLOGICAL DEPARTMENT

Issued under the authority of

THE DIRECTOR GENERAL OF METEOROLOGY, NEW DELHI
INDIA METEOROLOGICAL DEPARTMENT
MINISTRY OF EARTH SCIENCES
GOVERNMENT OF INDIA

Office of preparation

POSITIONAL ASTRONOMY CENTRE
INDIA METEOROLOGICAL DEPARTMENT
SALT LAKE, KOLKATA - 700 091

Copies available from:

In India :
The Controller of Publications
Civil Lines, Delhi - 110 054

Government of India Book Depot,
8, K. S. Roy Road, Kolkata - 700 001

Government of India, Kitab Mahal,
Baba Kharak Singh Marg, New Delhi

Government of India Book Depot,
New Marine Lines, Mumbai - 20

(And other agents selling Government of India publications)

PREFACE

The Indian Astronomical Ephemeris is published annually by the India Meteorological Department (IMD) for providing data to astronomers. The speciality of this publication is that it contains calendric information which caters to the requirement of the country's panchang makers and other users. Thus it has great civil and cultural significance. This has been the mandate given to the Positional Astronomy Centre at Kolkata by the Govt. of India.

The calculations of the Indian Calendar portion, such as tithi, nakshatra etc. are given in Indian Standard Time (IST) and covers an extended period upto 21st March 2020 which is the end of the year 1941 Saka Era of the Indian National Calendar. A separate note has also been given to explain the terminology and the basis of different calculations relating to the Indian Calendar.

The epoch of the standard reference system in this publication is J 2000.0 and the argument of the ephemerides is Terrestrial Time (TT). Resolutions of the International Astronomical Union (IAU) recommending the changes from time to time including a list of new IAU constants are given in Part VI - Indian Calendar and Explanation.

Our sincere thanks are due to the Nautical Almanac Office, United States Naval Observatory and Her Majesty's Nautical Almanac Office, U.K.

The work of preparation and publication of the Indian Astronomical Ephemeris for 2019 has been done under the supervision of Shri S. Sen, Director, Positional Astronomy Centre, India Meteorological Department, Kolkata.

Dr. K. J. Ramesh
Director General of Meteorology

Mausam Bhawan
New Delhi - 110 003
26th July, 2018 A.D.
(4 Sravana, 1940 Saka Era)

This page is intentionally kept blank

CONTENTS

CONTENTS

PART - I

TIME, SUN, MOON, PLANETS

Julian date for Standard epoch

1900 January 0, 12^h U.T.		=	JD	241	5020.0
B 1950.0	= 1950 Jan. 0.923	=	JD	243	3282.423
B 2019.0	= 2019 Jan. 0.635	=	JD	245	8484.135
J 2019.5	= 2019 July 2.875	=	JD	245	8667.375
J 2000.0	= 2000 Jan. 1.5	=	JD	245	1545.0

Tabulations of Julian date against calendar date for 2019 are given on pages 4 to12 and for other years are given at Table IX of Part-V on page 367.

The fraction of the year from 2019.5 is tabulated with the Besselian day numbers on pages 244-251.

The lengths of the principal years and mean months at 2019.0 as derived from the Sun's mean motion and mean Orbital elements respectively are:

Length of the year (ephemeris days) :

	d		d	h	m	s
Tropical (equinox to equinox)	365.242190	=	365	05	48	45.2
Sidereal (fixed star to fixed star)	365.256363	=	365	06	09	09.8
Anomalistic (perigee to perigee)	365. 259635	=	365	06	13	52.5
Eclipse (node to node)	346. 620074	=	346	14	52	54.4

Length of the Month (ephemeris days)

	d		d	h	m	s
Synodic (new moon to new moon)	29.5305888	=	29	12	44	02.9
Tropical (equinox to equinox)	27.3215822	=	27	07	43	04.7
Sidereal (fixed star to fixed star)	27.3216615	=	27	07	43	11.6
Anomalistic (perigee to perigee)	27.5545501	=	27	13	18	33.1
Nodical (node to node)	27.2122207	=	27	05	05	35.9

		h	m	s
Length of the day:	Mean Sidereal	23	56	04.09053 of mean Solar time.
	Mean Solar	24	03	56.55537 of mean Sidereal time.

CHRONOLOGICAL TABLE

CHRONOLOGICAL CYCLES

Golden Number or Lunar Cycle	VI	Solar Cycle	12
Epact	24	Roman Indiction	12
Dominical Letter	F		

CHRONOLOGICAL ERAS

The year 1941 of the Saka Era (Indian National Calendar) begins on March 22, 2019.
The year 1941 of the Saka Era or Saka Shalivahana (Lunisolar, Traditional Calendar) begins on April 6, 2019.
The year 1941 of the Saka Era (Solar, Traditional Calendar) begins on April 15, 2019.
The year 5120 of the Kali Era begins on April 14, 2019.
The year 2076 of the Vikram Samvat begins on April 6, 2019 (Chaitradi) and October 28, 2019 (Kartikadi) according to different systems of reckoning.
The year 1426 of the Bengali San begins on April 15, 2019.
The year 1195 of the Kollam Era begins on August 17, 2019.
Jovian year (Barhaspatya Varsa or 60-year cycle of Jupiter) 47 Pramadin begins on June 5, 2019 (North Indian Usage), and 33 Vikari on April 6, 2019 (Lunar Chaitradi) or April 14, 2019 (Solar) (South Indian Usage).
Vedanga Jyotisa year 4- Annuvatsara of the 5-year cycle (389 th cycle of Paitamaha Siddhanta) begins on February 5, 2019.
The year 2563 of the Buddha Nirvana era begins on May 18, 2019.
The year 2546 of the Mahavira Nirvana Era begins on April 17, 2019.
The year 1441 of the Mohammedan Era begins on September 1, 2019.
The year 1389 of the Yazdejardi Era begins on August 17, 2019 according to the Indian Parsi (Shahenshahi) Calendar.
The year 6732 of the Julian period begins on January 14, 2019.
The year 5780 of the Jewish Era (A.M.) begins on September 30, 2019.
The year 2795 of the Greek Olympiad, being the 3rd year of the 4-Year cycle (699 th Olympiad) begins on July, 2019.
The year 2772 of the Foundation of Rome (A.U.C.) begins on January 14, 2019.
The year 2768 of the Nabonassar begins on April 19, 2019.
The year 2331 of the Seleucidean era begins in the present-day usage of the Syrians on September 14 or October 14, 2019 according to different sects.
The Gregorian Year 2019 begins on January 1, 2019.

CALENDAR, 2019

Day of Month	Day of Year	Day of Week	Days since J 2019.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar		Phases of the Moon
						Day of Month	Day of Year	
					2458	1940 Saka Era		
Dec. 27	361	Thu	-187.875	-0.0137	479.5	Pausha 6	281	
28	362	Fri	186.875	-0.0110	480.5	7	282	
29	363	Sat	185.875	-0.0082	481.5	8	283	29-Last Quarter
30	364	Sun	184.875	-0.0055	482.5	9	284	9^h 34^m U.T.
Dec. 31	365	Mon	183.875	-0.0027	483.5	10	285	
Jan. 1	1	Tue	182.875	0.0000	484.5	11	286	
2	2	Wed	181.875	0.0027	485.5	12	287	
3	3	Thu	-180.875	0.0055	486.5	13	288	
4	4	Fri	179.875	0.0082	487.5	14	289	
5	5	Sat	178.875	0.0110	488.5	15	290	
6	6	Sun	177.875	0.0137	489.5	16	291	6-New Moon
7	7	Mon	176.875	0.0164	490.5	17	292	1^h 28^m U.T.
8	8	Tue	175.875	0.0192	491.5	18	293	
9	9	Wed	174.875	0.0219	492.5	19	294	
10	10	Thu	-173.875	0.0246	493.5	20	295	
11	11	Fri	172.875	0.0274	494.5	21	296	
12	12	Sat	171.875	0.0301	495.5	22	297	
13	13	Sun	170.875	0.0329	496.5	23	298	
14	14	Mon	169.875	0.0356	497.5	24	299	14-First Quarter
15	15	Tue	168.875	0.0383	498.5	25	300	6^h 46^m U.T.
16	16	Wed	167.875	0.0411	499.5	26	301	
17	17	Thu	-166.875	0.0438	500.5	27	302	
18	18	Fri	165.875	0.0465	501.5	28	303	
19	19	Sat	164.875	0.0493	502.5	29	304	
20	20	Sun	163.875	0.0520	503.5	30	305	
21	21	Mon	162.875	0.0548	504.5	Magha 1	306	21-Full Moon
22	22	Tue	161.875	0.0575	505.5	2	307	5^h 16^m U.T.
23	23	Wed	160.875	0.0602	506.5	3	308	
24	24	Thu	-159.875	0.0630	507.5	4	309	
25	25	Fri	158.875	0.0657	508.5	5	310	
26	26	Sat	157.875	0.0684	509.5	6	311	
27	27	Sun	156.875	0.0712	510.5	7	312	27-Last Quarter
28	28	Mon	155.875	0.0739	511.5	8	313	21^h 10^m U.T.
29	29	Tue	154.875	0.0767	512.5	9	314	
30	30	Wed	153.875	0.0794	513.5	10	315	
31	31	Thu	-152.875	0.0821	514.5	11	316	
Feb. 1	32	Fri	151.875	0.0849	515.5	12	317	
2	33	Sat	150.875	0.0876	516.5	13	318	
3	34	Sun	149.875	0.0904	517.5	14	319	
4	35	Mon	148.875	0.0931	518.5	15	320	4-New Moon
5	36	Tue	147.875	0.0958	519.5	16	321	21^h 04^m U.T.
6	37	Wed	-146.875	0.0986	520.5	17	322	

CALENDAR, 2019

Day of Month		Day of Year	Day of Week	Days since J 2019.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar Day of Month	Indian Calendar Day of Year	Phases of the Moon
						2458	1940 Saka Era		
Feb.	7	38	Thu	-145.875	0.1013	521.5	Magha 18	323	
	8	39	Fri	144.875	0.1040	522.5	19	324	
	9	40	Sat	143.875	0.1068	523.5	20	325	
	10	41	Sun	142.875	0.1095	524.5	21	326	
	11	42	Mon	141.875	0.1123	525.5	22	327	
	12	43	Tue	140.875	0.1150	526.5	23	328	12-First Quarter
	13	44	Wed	139.875	0.1177	527.5	24	329	$22^h\ 26^m$ U.T.
	14	45	Thu	-138.875	0.1205	528.5	25	330	
	15	46	Fri	137.875	0.1232	529.5	26	331	
	16	47	Sat	136.875	0.1259	530.5	27	332	
	17	48	Sun	135.875	0.1287	531.5	28	333	
	18	49	Mon	134.875	0.1314	532.5	29	334	
	19	50	Tue	133.875	0.1342	533.5	30	335	19-Full Moon
	20	51	Wed	132.875	0.1369	534.5	Phalguna 1	336	$15^h\ 54^m$ U.T.
	21	52	Thu	-131.875	0.1396	535.5	2	337	
	22	53	Fri	130.875	0.1424	536.5	3	338	
	23	54	Sat	129.875	0.1451	537.5	4	339	
	24	55	Sun	128.875	0.1478	538.5	5	340	
	25	56	Mon	127.875	0.1506	539.5	6	341	
	26	57	Tue	126.875	0.1533	540.5	7	342	26-Last Quarter
	27	58	Wed	125.875	0.1561	541.5	8	343	$11^h\ 28^m$ U.T.
	28	59	Thu	-124.875	0.1588	542.5	9	344	
Mar.	1	60	Fri	123.875	0.1615	543.5	10	345	
	2	61	Sat	122.875	0.1643	544.5	11	346	
	3	62	Sun	121.875	0.1670	545.5	12	347	
	4	63	Mon	120.875	0.1698	546.5	13	348	
	5	64	Tue	119.875	0.1725	547.5	14	349	
	6	65	Wed	118.875	0.1752	548.5	15	350	6-New Moon
									$16^h\ 04^m$ U.T.
	7	66	Thu	-117.875	0.1780	549.5	16	351	
	8	67	Fri	116.875	0.1807	550.5	17	352	
	9	68	Sat	115.875	0.1834	551.5	18	353	
	10	69	Sun	114.875	0.1862	552.5	19	354	
	11	70	Mon	113.875	0.1889	553.5	20	355	
	12	71	Tue	112.875	0.1917	554.5	21	356	
	13	72	Wed	111.875	0.1944	555.5	22	357	
	14	73	Thu	-110.875	0.1971	556.5	23	358	14-First Quarter
	15	74	Fri	109.875	0.1999	557.5	24	359	$10^h\ 27^m$ U.T.
	16	75	Sat	108.875	0.2026	558.5	25	360	
	17	76	Sun	107.875	0.2053	559.5	26	361	
	18	77	Mon	106.875	0.2081	560.5	27	362	
	19	78	Tue	105.875	0.2108	561.5	28	363	
	20	79	Wed	-104.875	0.2136	562.5	29	364	

CALENDAR, 2019

Day of Month	Day of Year	Day of Week	Days since J 2019.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar		Phases of the Moon
						Day of Month	Day of Year	
					2458	1940 Saka Era		
Mar. 21	80	Thu	-103.875	0.2163	563.5	Phalguna 30	365	21-Full Moon
22	81	Fri	102.875	0.2190	564.5	1941 Chaitra 1	1	1^h 43^m U.T.
23	82	Sat	101.875	0.2218	565.5	2	2	
24	83	Sun	100.875	0.2245	566.5	3	3	
25	84	Mon	99.875	0.2272	567.5	4	4	
26	85	Tue	98.875	0.2300	568.5	5	5	
27	86	Wed	97.875	0.2327	569.5	6	6	
28	87	Thu	-96.875	0.2355	570.5	7	7	28-Last Quarter
29	88	Fri	95.875	0.2382	571.5	8	8	4^h 10^m U.T.
30	89	Sat	94.875	0.2409	572.5	9	9	
31	90	Sun	93.875	0.2437	573.5	10	10	
Apr. 1	91	Mon	92.875	0.2464	574.5	11	11	
2	92	Tue	91.875	0.2491	575.5	12	12	
3	93	Wed	90.875	0.2519	576.5	13	13	
4	94	Thu	-89.875	0.2546	577.5	14	14	
5	95	Fri	88.875	0.2574	578.5	15	15	5-New Moon
6	96	Sat	87.875	0.2601	579.5	16	16	8^h 50^m U.T.
7	97	Sun	86.875	0.2628	580.5	17	17	
8	98	Mon	85.875	0.2656	581.5	18	18	
9	99	Tue	84.875	0.2683	582.5	19	19	
10	100	Wed	83.875	0.2711	583.5	20	20	
11	101	Thu	-82.875	0.2738	584.5	21	21	
12	102	Fri	81.875	0.2765	585.5	22	22	12-First Quarter
13	103	Sat	80.875	0.2793	586.5	23	23	19^h 06^m U.T.
14	104	Sun	79.875	0.2820	587.5	24	24	
15	105	Mon	78.875	0.2847	588.5	25	25	
16	106	Tue	77.875	0.2875	589.5	26	26	
17	107	Wed	76.875	0.2902	590.5	27	27	
18	108	Thu	-75.875	0.2930	591.5	28	28	
19	109	Fri	74.875	0.2957	592.5	29	29	19-Full Moon
20	110	Sat	73.875	0.2984	593.5	30	30	11^h 12^m U.T.
21	111	Sun	72.875	0.3012	594.5	Vaisakha 1	31	
22	112	Mon	71.875	0.3039	595.5	2	32	
23	113	Tue	70.875	0.3066	596.5	3	33	
24	114	Wed	69.875	0.3094	597.5	4	34	
25	115	Thu	-68.875	0.3121	598.5	5	35	
26	116	Fri	67.875	0.3149	599.5	6	36	26-Last Quarter
27	117	Sat	66.875	0.3176	600.5	7	37	22^h 18^m U.T.
28	118	Sun	65.875	0.3203	601.5	8	38	
29	119	Mon	64.875	0.3231	602.5	9	39	
30	120	Tue	63.875	0.3258	603.5	10	40	
May 1	121	Wed	-62.875	0.3285	604.5	11	41	

CALENDAR, 2019

Day of Month		Day of Year	Day of Week	Days since J 2019.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar		Phases of the Moon
							Day of Month	Day of Year	
						2458	1941 Saka Era		
May	2	122	Thu	-61.875	0.3313	605.5	Vaisakha 12	42	
	3	123	Fri	60.875	0.3340	606.5	13	43	
	4	124	Sat	59.875	0.3368	607.5	14	44	4-New Moon
	5	125	Sun	58.875	0.3395	608.5	15	45	$22^h\ 45^m$ U.T.
	6	126	Mon	57.875	0.3422	609.5	16	46	
	7	127	Tue	56.875	0.3450	610.5	17	47	
	8	128	Wed	55.875	0.3477	611.5	18	48	
	9	129	Thu	-54.875	0.3505	612.5	19	49	
	10	130	Fri	53.875	0.3532	613.5	20	50	
	11	131	Sat	52.875	0.3559	614.5	21	51	
	12	132	Sun	51.875	0.3587	615.5	22	52	12-First Quarter
	13	133	Mon	50.875	0.3614	616.5	23	53	$1^h\ 12^m$ U.T.
	14	134	Tue	49.875	0.3641	617.5	24	54	
	15	135	Wed	48.875	0.3669	618.5	25	55	
	16	136	Thu	-47.875	0.3696	619.5	26	56	
	17	137	Fri	46.875	0.3724	620.5	27	57	
	18	138	Sat	45.875	0.3751	621.5	28	58	18-Full Moon
	19	139	Sun	44.875	0.3778	622.5	29	59	$21^h\ 11^m$ U.T.
	20	140	Mon	43.875	0.3806	623.5	30	60	
	21	141	Tue	42.875	0.3833	624.5	31	61	
	22	142	Wed	41.875	0.3860	625.5	Jyaistha 1	62	
	23	143	Thu	-40.875	0.3888	626.5	2	63	
	24	144	Fri	39.875	0.3915	627.5	3	64	
	25	145	Sat	38.875	0.3943	628.5	4	65	
	26	146	Sun	37.875	0.3970	629.5	5	66	26-Last Quarter
	27	147	Mon	36.875	0.3997	630.5	6	67	$16^h\ 34^m$ U.T.
	28	148	Tue	35.875	0.4025	631.5	7	68	
	29	149	Wed	34.875	0.4052	632.5	8	69	
	30	150	Thu	-33.875	0.4079	633.5	9	70	
	31	151	Fri	32.875	0.4107	634.5	10	71	
June	1	152	Sat	31.875	0.4134	635.5	11	72	
	2	153	Sun	30.875	0.4162	636.5	12	73	
	3	154	Mon	29.875	0.4189	637.5	13	74	3-New Moon
	4	155	Tue	28.875	0.4216	638.5	14	75	$10^h\ 02^m$ U.T.
	5	156	Wed	27.875	0.4244	639.5	15	76	
	6	157	Thu	-26.875	0.4271	640.5	16	77	
	7	158	Fri	25.875	0.4299	641.5	17	78	
	8	159	Sat	24.875	0.4326	642.5	18	79	
	9	160	Sun	23.875	0.4353	643.5	19	80	
	10	161	Mon	22.875	0.4381	644.5	20	81	10-First Quarter
	11	162	Tue	21.875	0.4408	645.5	21	82	$5^h\ 59^m$ U.T.
	12	163	Wed	-20.875	0.4435	646.5	22	83	

CALENDAR, 2019

Day of Month		Day of Year	Day of Week	Days since J 2019.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar Day of Month	Indian Calendar Day of Year	Phases of the Moon
						2458	1941 Saka Era		
June	13	164	Thu	-19.875	0.4463	647.5	Jyaishtha 23	84	
	14	165	Fri	18.875	0.4490	648.5	24	85	
	15	166	Sat	17.875	0.4518	649.5	25	86	
	16	167	Sun	16.875	0.4545	650.5	26	87	
	17	168	Mon	15.875	0.4572	651.5	27	88	17-Full Moon
	18	169	Tue	14.875	0.4600	652.5	28	89	$8^h\ 31^m$ U.T.
	19	170	Wed	13.875	0.4627	653.5	29	90	
	20	171	Thu	-12.875	0.4654	654.5	30	91	
	21	172	Fri	11.875	0.4682	655.5	31	92	
	22	173	Sat	10.875	0.4709	656.5	Ashadha 1	93	
	23	174	Sun	9.875	0.4737	657.5	2	94	
	24	175	Mon	8.875	0.4764	658.5	3	95	
	25	176	Tue	7.875	0.4791	659.5	4	96	25-Last Quarter
	26	177	Wed	6.875	0.4819	660.5	5	97	$9^h\ 46^m$ U.T.
	27	178	Thu	-5.875	0.4846	661.5	6	98	
	28	179	Fri	4.875	0.4873	662.5	7	99	
	29	180	Sat	3.875	0.4901	663.5	8	100	
	30	181	Sun	2.875	0.4928	664.5	9	101	
July	1	182	Mon	1.875	0.4956	665.5	10	102	
	2	183	Tue	-0.875	0.4983	666.5	11	103	2-New Moon
	3	184	Wed	+0.125	0.5010	667.5	12	104	$19^h\ 16^m$ U.T.
	4	185	Thu	+1.125	0.5038	668.5	13	105	
	5	186	Fri	2.125	0.5065	669.5	14	106	
	6	187	Sat	3.125	0.5093	670.5	15	107	
	7	188	Sun	4.125	0.5120	671.5	16	108	
	8	189	Mon	5.125	0.5147	672.5	17	109	
	9	190	Tue	6.125	0.5175	673.5	18	110	9-First Quarter
	10	191	Wed	7.125	0.5202	674.5	19	111	$10^h\ 55^m$ U.T.
	11	192	Thu	+8.125	0.5229	675.5	20	112	
	12	193	Fri	9.125	0.5257	676.5	21	113	
	13	194	Sat	10.125	0.5284	677.5	22	114	
	14	195	Sun	11.125	0.5312	678.5	23	115	
	15	196	Mon	12.125	0.5339	679.5	24	116	
	16	197	Tue	13.125	0.5366	680.5	25	117	16-Full Moon
	17	198	Wed	14.125	0.5394	681.5	26	118	$21^h\ 38^m$ U.T.
	18	199	Thu	+15.125	0.5421	682.5	27	119	
	19	200	Fri	16.125	0.5448	683.5	28	120	
	20	201	Sat	17.125	0.5476	684.5	29	121	
	21	202	Sun	18.125	0.5503	685.5	30	122	
	22	203	Mon	19.125	0.5531	686.5	31	123	
	23	204	Tue	20.125	0.5558	687.5	Sravana 1	124	
	24	205	Wed	+21.125	0.5585	688.5	2	125	

CALENDAR, 2019

Day of Month		Day of Year	Day of Week	Days since J 2019.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar Day of Month	Indian Calendar Day of Year	Phases of the Moon
						2458	1941 Saka Era		
July	25	206	Thu	+22.125	0.5613	689.5	Sravana 3	126	25-Last Quarter
	26	207	Fri	23.125	0.5640	690.5	4	127	$1^h\ 18^m$ U.T.
	27	208	Sat	24.125	0.5667	691.5	5	128	
	28	209	Sun	25.125	0.5695	692.5	6	129	
	29	210	Mon	26.125	0.5722	693.5	7	130	
	30	211	Tue	27.125	0.5750	694.5	8	131	
	31	212	Wed	28.125	0.5777	695.5	9	132	
Aug.	1	213	Thu	+29.125	0.5804	696.5	10	133	1-New Moon
	2	214	Fri	30.125	0.5832	697.5	11	134	$3^h\ 12^m$ U.T.
	3	215	Sat	31.125	0.5859	698.5	12	135	
	4	216	Sun	32.125	0.5887	699.5	13	136	
	5	217	Mon	33.125	0.5914	700.5	14	137	
	6	218	Tue	34.125	0.5941	701.5	15	138	
	7	219	Wed	35.125	0.5969	702.5	16	139	7-First Quarter $17^h\ 31^m$ U.T.
	8	220	Thu	+36.125	0.5996	703.5	17	140	
	9	221	Fri	37.125	0.6023	704.5	18	141	
	10	222	Sat	38.125	0.6051	705.5	19	142	
	11	223	Sun	39.125	0.6078	706.5	20	143	
	12	224	Mon	40.125	0.6106	707.5	21	144	
	13	225	Tue	41.125	0.6133	708.5	22	145	
	14	226	Wed	42.125	0.6160	709.5	23	146	
	15	227	Thu	+43.125	0.6188	710.5	24	147	15-Full Moon
	16	228	Fri	44.125	0.6215	711.5	25	148	$12^h\ 29^m$ U.T.
	17	229	Sat	45.125	0.6242	712.5	26	149	
	18	230	Sun	46.125	0.6270	713.5	27	150	
	19	231	Mon	47.125	0.6297	714.5	28	151	
	20	232	Tue	48.125	0.6325	715.5	29	152	
	21	233	Wed	49.125	0.6352	716.5	30	153	
	22	234	Thu	+50.125	0.6379	717.5	31	154	
	23	235	Fri	51.125	0.6407	718.5	Bhadra 1	155	23-Last Quarter
	24	236	Sat	52.125	0.6434	719.5	2	156	$14^h\ 56^m$ U.T.
	25	237	Sun	53.125	0.6461	720.5	3	157	
	26	238	Mon	54.125	0.6489	721.5	4	158	
	27	239	Tue	55.125	0.6516	722.5	5	159	
	28	240	Wed	56.125	0.6544	723.5	6	160	
	29	241	Thu	+57.125	0.6571	724.5	7	161	
	30	242	Fri	58.125	0.6598	725.5	8	162	30-New Moon
	31	243	Sat	59.125	0.6626	726.5	9	163	$10^h\ 37^m$ U.T.
Sept.	1	244	Sun	60.125	0.6653	727.5	10	164	
	2	245	Mon	61.125	0.6680	728.5	11	165	
	3	246	Tue	62.125	0.6708	729.5	12	166	
	4	247	Wed	+63.125	0.6735	730.5	13	167	

CALENDAR, 2019

Day of Month		Day of Year	Day of Week	Days since J 2019.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar Day of Month	Indian Calendar Day of Year	Phases of the Moon
						2458	1941 Saka Era		
Sept.	5	248	Thu	+64.125	0.6763	731.5	Bhadra 14	168	
	6	249	Fri	65.125	0.6790	732.5	15	169	6-First Quarter
	7	250	Sat	66.125	0.6817	733.5	16	170	3^h 10^m U.T.
	8	251	Sun	67.125	0.6845	734.5	17	171	
	9	252	Mon	68.125	0.6872	735.5	18	172	
	10	253	Tue	69.125	0.6900	736.5	19	173	
	11	254	Wed	70.125	0.6927	737.5	20	174	
	12	255	Thu	+71.125	0.6954	738.5	21	175	
	13	256	Fri	72.125	0.6982	739.5	22	176	
	14	257	Sat	73.125	0.7009	740.5	23	177	14-Full Moon
	15	258	Sun	74.125	0.7036	741.5	24	178	4^h 33^m U.T.
	16	259	Mon	75.125	0.7064	742.5	25	179	
	17	260	Tue	76.125	0.7091	743.5	26	180	
	18	261	Wed	77.125	0.7119	744.5	27	181	
	19	262	Thu	+78.125	0.7146	745.5	28	182	
	20	263	Fri	79.125	0.7173	746.5	29	183	
	21	264	Sat	80.125	0.7201	747.5	30	184	
	22	265	Sun	81.125	0.7228	748.5	31	185	22-Last Quarter
	23	266	Mon	82.125	0.7255	749.5	Asvina 1	186	2^h 41^m U.T.
	24	267	Tue	83.125	0.7283	750.5	2	187	
	25	268	Wed	84.125	0.7310	751.5	3	188	
	26	269	Thu	+85.125	0.7338	752.5	4	189	
	27	270	Fri	86.125	0.7365	753.5	5	190	
	28	271	Sat	87.125	0.7392	754.5	6	191	28-New Moon
	29	272	Sun	88.125	0.7420	755.5	7	192	18^h 26^m U.T.
	30	273	Mon	89.125	0.7447	756.5	8	193	
Oct.	1	274	Tue	90.125	0.7474	757.5	9	194	
	2	275	Wed	91.125	0.7502	758.5	10	195	
	3	276	Thu	+92.125	0.7529	759.5	11	196	
	4	277	Fri	93.125	0.7557	760.5	12	197	
	5	278	Sat	94.125	0.7584	761.5	13	198	5-First Quarter
	6	279	Sun	95.125	0.7611	762.5	14	199	16^h 47^m U.T.
	7	280	Mon	96.125	0.7639	763.5	15	200	
	8	281	Tue	97.125	0.7666	764.5	16	201	
	9	282	Wed	98.125	0.7694	765.5	17	202	
	10	283	Thu	+99.125	0.7721	766.5	18	203	
	11	284	Fri	100.125	0.7748	767.5	19	204	
	12	285	Sat	101.125	0.7776	768.5	20	205	
	13	286	Sun	102.125	0.7803	769.5	21	206	13-Full Moon
	14	287	Mon	103.125	0.7830	770.5	22	207	21^h 08^m U.T.
	15	288	Tue	104.125	0.7858	771.5	23	208	
	16	289	Wed	+105.125	0.7885	772.5	24	209	

CALENDAR, 2019

Day of Month		Day of Year	Day of Week	Days since J 2019.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar		Phases of the Moon
							Day of Month	Day of Year	
						2458	1941 Saka Era		
Oct.	17	290	Thu	+106.125	0.7913	773.5	Asvina 25	210	
	18	291	Fri	107.125	0.7940	774.5	26	211	
	19	292	Sat	108.125	0.7967	775.5	27	212	
	20	293	Sun	109.125	0.7995	776.5	28	213	
	21	294	Mon	110.125	0.8022	777.5	29	214	21-Last Quarter
	22	295	Tue	111.125	0.8049	778.5	30	215	$12^h\ 39^m$ U.T.
	23	296	Wed	112.125	0.8077	779.5	Kartika 1	216	
	24	297	Thu	+113.125	0.8104	780.5	2	217	
	25	298	Fri	114.125	0.8132	781.5	3	218	
	26	299	Sat	115.125	0.8159	782.5	4	219	
	27	300	Sun	116.125	0.8186	783.5	5	220	
	28	301	Mon	117.125	0.8214	784.5	6	221	28-New Moon
	29	302	Tue	118.125	0.8241	785.5	7	222	$3^h\ 38^m$ U.T.
	30	303	Wed	119.125	0.8268	786.5	8	223	
	31	304	Thu	+120.125	0.8296	787.5	9	224	
Nov.	1	305	Fri	121.125	0.8323	788.5	10	225	
	2	306	Sat	122.125	0.8351	789.5	11	226	
	3	307	Sun	123.125	0.8378	790.5	12	227	
	4	308	Mon	124.125	0.8405	791.5	13	228	4-First Quarter
	5	309	Tue	125.125	0.8433	792.5	14	229	$10^h\ 23^m$ U.T.
	6	310	Wed	126.125	0.8460	793.5	15	230	
	7	311	Thu	+127.125	0.8488	794.5	16	231	
	8	312	Fri	128.125	0.8515	795.5	17	232	
	9	313	Sat	129.125	0.8542	796.5	18	233	
	10	314	Sun	130.125	0.8570	797.5	19	234	
	11	315	Mon	131.125	0.8597	798.5	20	235	
	12	316	Tue	132.125	0.8624	799.5	21	236	12-Full Moon
	13	317	Wed	133.125	0.8652	800.5	22	237	$13^h\ 34^m$ U.T.
	14	318	Thu	+134.125	0.8679	801.5	23	238	
	15	319	Fri	135.125	0.8707	802.5	24	239	
	16	320	Sat	136.125	0.8734	803.5	25	240	
	17	321	Sun	137.125	0.8761	804.5	26	241	
	18	322	Mon	138.125	0.8789	805.5	27	242	
	19	323	Tue	139.125	0.8816	806.5	28	243	19-Last Quarter
	20	324	Wed	140.125	0.8843	807.5	29	244	$21^h\ 11^m$ U.T.
	21	325	Thu	+141.125	0.8871	808.5	30	245	
	22	326	Fri	142.125	0.8898	809.5	Agrahayana 1	246	
	23	327	Sat	143.125	0.8926	810.5	2	247	
	24	328	Sun	144.125	0.8953	811.5	3	248	
	25	329	Mon	145.125	0.8980	812.5	4	249	
	26	330	Tue	146.125	0.9008	813.5	5	250	26-New Moon
	27	331	Wed	+147.125	0.9035	814.5	6	251	$15^h\ 06^m$ U.T.

CALENDAR, 2019

Day of Month		Day of Year	Day of Week	Days since J 2019.5	Fraction of Year since Jan. 1.0	Julian Day (at 0h U.T.)	Indian Calendar Day of Month	Indian Calendar Day of Year	Phases of the Moon
						2458	1941 Saka Era		
Nov.	28	332	Thu	+148.125	0.9062	815.5	Agrahayana 7	252	
	29	333	Fri	149.125	0.9090	816.5	8	253	
	30	334	Sat	150.125	0.9117	817.5	9	254	
Dec.	1	335	Sun	151.125	0.9145	818.5	10	255	
	2	336	Mon	152.125	0.9172	819.5	11	256	
	3	337	Tue	153.125	0.9199	820.5	12	257	
	4	338	Wed	154.125	0.9227	821.5	13	258	4-First Quarter $6^h\ 58^m$ U.T.
	5	339	Thu	+155.125	0.9254	822.5	14	259	
	6	340	Fri	156.125	0.9282	823.5	15	260	
	7	341	Sat	157.125	0.9309	824.5	16	261	
	8	342	Sun	158.125	0.9336	825.5	17	262	
	9	343	Mon	159.125	0.9364	826.5	18	263	
	10	344	Tue	160.125	0.9391	827.5	19	264	
	11	345	Wed	161.125	0.9418	828.5	20	265	
	12	346	Thu	+162.125	0.9446	829.5	21	266	12-Full Moon
	13	347	Fri	163.125	0.9473	830.5	22	267	$5^h\ 12^m$ U.T.
	14	348	Sat	164.125	0.9501	831.5	23	268	
	15	349	Sun	165.125	0.9528	832.5	24	269	
	16	350	Mon	166.125	0.9555	833.5	25	270	
	17	351	Tue	167.125	0.9583	834.5	26	271	
	18	352	Wed	168.125	0.9610	835.5	27	272	
	19	353	Thu	+169.125	0.9637	836.5	28	273	19-Last Quarter
	20	354	Fri	170.125	0.9665	837.5	29	274	$4^h\ 57^m$ U.T.
	21	355	Sat	171.125	0.9692	838.5	30	275	
	22	356	Sun	172.125	0.9720	839.5	Pausha 1	276	
	23	357	Mon	173.125	0.9747	840.5	2	277	
	24	358	Tue	174.125	0.9774	841.5	3	278	
	25	359	Wed	175.125	0.9802	842.5	4	279	
	26	360	Thu	+176.125	0.9829	843.5	5	280	26-New Moon
	27	361	Fri	177.125	0.9856	844.5	6	281	$5^h\ 13^m$ U.T.
	28	362	Sat	178.125	0.9884	845.5	7	282	
	29	363	Sun	179.125	0.9911	846.5	8	283	
	30	364	Mon	180.125	0.9939	847.5	9	284	
	31	365	Tue	181.125	0.9966	848.5	10	285	
	32	366	Wed	+182.125	0.9993	849.5	11	286	

The new epoch is the middle of the Julian year, denoted by J 2019.5 (i.e. 2019, July 2.875) where the length of the Julian year is taken to be 365.25 days.

The Fraction of year is reckoned from January 1,0^h U.T and is based on the tropical year of 365.2422 days. The Julian Day begins at noon. In order to obtain the Julian Day Number completed at noon as given in Table IX, increase the above figure by 0.5.

The Day of year of the Gregorian Calendar is reckoned from January 1, and that of the Indian Calendar from Chaitra 1.

SIDEREAL TIME, 2019

Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)			Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)		
		h	m	s	s	h	m	s			h	m	s	s	h	m	s
Jan.	0	6	37	29.970	-0.922	17	19	39.242	Feb.	15	9	38	51.516	-0.890	14	18	47.406
	1	6	41	26.525	0.923	17	15	43.332		16	9	42	48.072	0.885	14	14	51.497
	2	6	45	23.080	0.921	17	11	47.423		17	9	46	44.627	0.878	14	10	55.587
	3	6	49	19.636	0.917	17	07	51.513		18	9	50	41.183	0.874	14	06	59.678
	4	6	53	16.191	0.911	17	03	55.604		19	9	54	37.738	0.872	14	03	03.768
	5	6	57	12.746	0.904	16	59	59.695		20	9	58	34.293	0.875	13	59	07.859
	6	7	01	09.302	-0.897	16	56	03.785		21	10	02	30.849	-0.881	13	55	11.950
	7	7	05	05.857	0.891	16	52	07.876		22	10	06	27.404	0.889	13	51	16.040
	8	7	09	02.412	0.887	16	48	11.966		23	10	10	23.959	0.897	13	47	20.131
	9	7	12	58.968	0.885	16	44	16.057		24	10	14	20.515	0.903	13	43	24.221
	10	7	16	55.523	0.885	16	40	20.147		25	10	18	17.070	0.907	13	39	28.312
	11	7	20	52.079	0.887	16	36	24.238		26	10	22	13.626	0.908	13	35	32.402
	12	7	24	48.634	-0.890	16	32	28.328		27	10	26	10.181	-0.907	13	31	36.493
	13	7	28	45.189	0.894	16	28	32.419		28	10	30	06.736	0.905	13	27	40.583
	14	7	32	41.745	0.898	16	24	36.509	Mar.	1	10	34	03.292	0.903	13	23	44.674
	15	7	36	38.300	0.901	16	20	40.600		2	10	37	59.847	0.901	13	19	48.764
	16	7	40	34.855	0.902	16	16	44.690		3	10	41	56.402	0.901	13	15	52.855
	17	7	44	31.411	0.900	16	12	48.781		4	10	45	52.958	0.903	13	11	56.945
	18	7	48	27.966	-0.894	16	08	52.871		5	10	49	49.513	-0.906	13	08	01.036
	19	7	52	24.522	0.886	16	04	56.962		6	10	53	46.068	0.912	13	04	05.126
	20	7	56	21.077	0.876	16	01	01.053		7	10	57	42.624	0.920	13	00	09.217
	21	8	00	17.632	0.868	15	57	05.143		8	11	01	39.179	0.928	12	56	13.307
	22	8	04	14.188	0.861	15	53	09.234		9	11	05	35.735	0.937	12	52	17.398
	23	8	08	10.743	0.859	15	49	13.324		10	11	09	32.290	0.945	12	48	21.488
	24	8	12	07.298	-0.861	15	45	17.415		11	11	13	28.845	-0.952	12	44	25.579
	25	8	16	03.854	0.865	15	41	21.505		12	11	17	25.401	0.956	12	40	29.670
	26	8	19	60.409	0.871	15	37	25.596		13	11	21	21.956	0.958	12	36	33.760
	27	8	23	56.964	0.876	15	33	29.686		14	11	25	18.511	0.957	12	32	37.851
	28	8	27	53.520	0.879	15	29	33.777		15	11	29	15.067	0.954	12	28	41.941
	29	8	31	50.075	0.879	15	25	37.867		16	11	33	11.622	0.949	12	24	46.032
	30	8	35	46.631	-0.878	15	21	41.958		17	11	37	08.178	-0.946	12	20	50.122
	31	8	39	43.186	0.874	15	17	46.048		18	11	41	04.733	0.945	12	16	54.213
Feb.	1	8	43	39.741	0.870	15	13	50.139		19	11	45	01.288	0.947	12	12	58.303
	2	8	47	36.297	0.865	15	09	54.229		20	11	48	57.844	0.953	12	09	02.394
	3	8	51	32.852	0.862	15	05	58.320		21	11	52	54.399	0.962	12	05	06.484
	4	8	55	29.407	0.859	15	02	02.410		22	11	56	50.954	0.971	12	01	10.575
	5	8	59	25.963	-0.859	14	58	06.501		23	12	00	47.510	-0.980	11	57	14.665
	6	9	03	22.518	0.861	14	54	10.592		24	12	04	44.065	0.985	11	53	18.756
	7	9	07	19.074	0.865	14	50	14.682		25	12	08	40.620	0.988	11	49	22.846
	8	9	11	15.629	0.870	14	46	18.773		26	12	12	37.176	0.988	11	45	26.937
	9	9	15	12.184	0.877	14	42	22.863		27	12	16	33.731	0.987	11	41	31.027
	10	9	19	08.740	0.884	14	38	26.954		28	12	20	30.287	0.985	11	37	35.118
	11	9	23	05.295	-0.890	14	34	31.044		29	12	24	26.842	-0.983	11	33	39.209
	12	9	27	01.850	0.894	14	30	35.135		30	12	28	23.397	0.983	11	29	43.299
	13	9	30	58.406	0.896	14	26	39.225		31	12	32	19.953	0.984	11	25	47.390
	14	9	34	54.961	0.894	14	22	43.316	Apr.	1	12	36	16.508	0.987	11	21	51.480
	15	9	38	51.516	-0.890	14	18	47.406		2	12	40	13.063	-0.993	11	17	55.571

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

SIDEREAL TIME, 2019

Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)			Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinoxes at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)		
		h	m	s	s	h	m	s			h	m	s	s	h	m	s
Apr.	1	12	36	16.508	-0.987	11	21	51.480	May	17	15	37	38.055	-1.071	8	20	59.645
	2	12	40	13.063	0.993	11	17	55.571		18	15	41	34.610	1.073	8	17	03.735
	3	12	44	09.619	1.000	11	13	59.661		19	15	45	31.166	1.071	8	13	07.826
	4	12	48	06.174	1.008	11	10	03.752		20	15	49	27.721	1.067	8	09	11.916
	5	12	52	02.730	1.017	11	06	07.842		21	15	53	24.276	1.061	8	05	16.007
	6	12	55	59.285	1.025	11	02	11.933		22	15	57	20.832	1.054	8	01	20.097
	7	12	59	55.840	-1.032	10	58	16.023		23	16	01	17.387	-1.048	7	57	24.188
	8	13	03	52.396	1.037	10	54	20.114		24	16	05	13.943	1.044	7	53	28.278
	9	13	07	48.951	1.038	10	50	24.204		25	16	09	10.498	1.041	7	49	32.369
	10	13	11	45.506	1.037	10	46	28.295		26	16	13	07.053	1.041	7	45	36.459
	11	13	15	42.062	1.034	10	42	32.385		27	16	17	03.609	1.043	7	41	40.550
	12	13	19	38.617	1.030	10	38	36.476		28	16	20	60.164	1.047	7	37	44.640
	13	13	23	35.172	-1.025	10	34	40.567		29	16	24	56.719	-1.051	7	33	48.731
	14	13	27	31.728	1.023	10	30	44.657		30	16	28	53.275	1.056	7	29	52.821
	15	13	31	28.283	1.024	10	26	48.748		31	16	32	49.830	1.059	7	25	56.912
	16	13	35	24.839	1.028	10	22	52.838	June	1	16	36	46.386	1.061	7	22	01.002
	17	13	39	21.394	1.034	10	18	56.929		2	16	40	42.941	1.060	7	18	05.093
	18	13	43	17.949	1.043	10	15	01.019		3	16	44	39.496	1.056	7	14	09.184
	19	13	47	14.505	-1.050	10	11	05.110		4	16	48	36.052	-1.050	7	10	13.274
	20	13	51	11.060	1.056	10	07	09.200		5	16	52	32.607	1.041	7	06	17.365
	21	13	55	07.615	1.059	10	03	13.291		6	16	56	29.162	1.031	7	02	21.455
	22	13	59	04.171	1.058	9	59	17.381		7	17	00	25.718	1.024	6	58	25.546
	23	14	02	60.726	1.055	9	55	21.472		8	17	04	22.273	1.018	6	54	29.636
	24	14	06	57.282	1.052	9	51	25.562		9	17	08	18.828	1.017	6	50	33.727
	25	14	10	53.837	-1.048	9	47	29.653		10	17	12	15.384	-1.018	6	46	37.817
	26	14	14	50.392	1.045	9	43	33.743		11	17	16	11.939	1.022	6	42	41.908
	27	14	18	46.948	1.043	9	39	37.834		12	17	20	08.495	1.026	6	38	45.998
	28	14	22	43.503	1.044	9	35	41.925		13	17	24	05.050	1.029	6	34	50.089
	29	14	26	40.058	1.047	9	31	46.015		14	17	28	01.605	1.030	6	30	54.179
	30	14	30	36.614	1.052	9	27	50.105		15	17	31	58.161	1.029	6	26	58.270
May	1	14	34	33.169	-1.058	9	23	54.196		16	17	35	54.716	-1.024	6	23	02.360
	2	14	38	29.724	1.065	9	19	58.287		17	17	39	51.271	1.017	6	19	06.451
	3	14	42	26.280	1.071	9	16	02.377		18	17	43	47.827	1.010	6	15	10.542
	4	14	46	22.835	1.076	9	12	06.468		19	17	47	44.382	1.002	6	11	14.632
	5	14	50	19.391	1.080	9	08	10.558		20	17	51	40.938	0.996	6	07	18.723
	6	14	54	15.946	1.080	9	04	14.649		21	17	55	37.493	0.992	6	03	22.813
	7	14	58	12.501	-1.077	9	00	18.739		22	17	59	34.048	-0.990	5	59	26.904
	8	15	02	09.057	1.072	8	56	22.830		23	18	03	30.604	0.990	5	55	30.994
	9	15	06	05.612	1.065	8	52	26.920		24	18	07	27.159	0.992	5	51	35.085
	10	15	10	02.167	1.058	8	48	31.011		25	18	11	23.714	0.996	5	47	39.175
	11	15	13	58.723	1.053	8	44	35.101		26	18	15	20.270	1.000	5	43	43.266
	12	15	17	55.278	1.051	8	40	39.192		27	18	19	16.825	1.003	5	39	47.356
	13	15	21	51.834	-1.052	8	36	43.282		28	18	23	13.380	-1.005	5	35	51.447
	14	15	25	48.389	1.056	8	32	47.373		29	18	27	09.936	1.005	5	31	55.537
	15	15	29	44.944	1.061	8	28	51.463		30	18	31	06.491	1.002	5	27	59.628
	16	15	33	41.500	1.067	8	24	55.554	July	1	18	35	03.047	0.996	5	24	03.718
	17	15	37	38.055	-1.071	8	20	59.645		2	18	38	59.602	-0.987	5	20	07.809

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

SIDEREAL TIME, 2019

Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinox-es at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)			Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinox-es at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)		
		h	m	s	s	h	m	s			h	m	s	s	h	m	s
July	1	18	35	03.047	-0.996	5	24	03.718	Aug.	16	21	36	24.594	-0.938	2	23	11.883
	2	18	38	59.602	0.987	5	20	07.809		17	21	40	21.149	0.943	2	19	15.973
	3	18	42	56.157	0.977	5	16	11.899		18	21	44	17.704	0.949	2	15	20.064
	4	18	46	52.713	0.968	5	12	15.990		19	21	48	14.260	0.956	2	11	24.154
	5	18	50	49.268	0.962	5	08	20.080		20	21	52	10.815	0.964	2	07	28.245
	6	18	54	45.823	0.959	5	04	24.171		21	21	56	07.370	0.970	2	03	32.335
	7	18	58	42.379	-0.959	5	00	28.262		22	22	00	03.926	-0.976	1	59	36.426
	8	19	02	38.934	0.963	4	56	32.352		23	22	03	60.481	0.979	1	55	40.517
	9	19	06	35.490	0.967	4	52	36.443		24	22	07	57.036	0.979	1	51	44.607
	10	19	10	32.045	0.971	4	48	40.533		25	22	11	53.592	0.976	1	47	48.698
	11	19	14	28.600	0.973	4	44	44.624		26	22	15	50.147	0.972	1	43	52.788
	12	19	18	25.156	0.973	4	40	48.714		27	22	19	46.703	0.966	1	39	56.879
	13	19	22	21.711	-0.969	4	36	52.805		28	22	23	43.258	-0.962	1	36	00.969
	14	19	26	18.266	0.964	4	32	56.895		29	22	27	39.813	0.959	1	32	05.060
	15	19	30	14.822	0.957	4	29	00.986		30	22	31	36.369	0.961	1	28	09.150
	16	19	34	11.377	0.951	4	25	05.076		31	22	35	32.924	0.966	1	24	13.241
	17	19	38	07.932	0.945	4	21	09.167	Sept.	1	22	39	29.479	0.974	1	20	17.331
	18	19	42	04.488	0.941	4	17	13.257		2	22	43	26.035	0.983	1	16	21.422
	19	19	46	01.043	-0.939	4	13	17.348		3	22	47	22.590	-0.990	1	12	25.512
	20	19	49	57.599	0.940	4	09	21.438		4	22	51	19.146	0.995	1	08	29.603
	21	19	53	54.154	0.943	4	05	25.529		5	22	55	15.701	0.997	1	04	33.693
	22	19	57	50.709	0.947	4	01	29.619		6	22	59	12.256	0.996	1	00	37.784
	23	20	01	47.265	0.952	3	57	33.710		7	23	03	08.812	0.994	0	56	41.874
	24	20	05	43.820	0.958	3	53	37.801		8	23	07	05.367	0.991	0	52	45.965
	25	20	09	40.375	-0.962	3	49	41.891		9	23	11	01.922	-0.989	0	48	50.055
	26	20	13	36.931	0.964	3	45	45.982		10	23	14	58.478	0.988	0	44	54.146
	27	20	17	33.486	0.964	3	41	50.072		11	23	18	55.033	0.989	0	40	58.237
	28	20	21	30.042	0.960	3	37	54.163		12	23	22	51.588	0.993	0	37	02.327
	29	20	25	26.597	0.954	3	33	58.253		13	23	26	48.144	0.999	0	33	06.418
	30	20	29	23.152	0.947	3	30	02.344		14	23	30	44.699	1.006	0	29	10.508
	31	20	33	19.708	-0.939	3	26	06.434		15	23	34	41.255	-1.015	0	25	14.599
Aug.	1	20	37	16.263	0.932	3	22	10.525		16	23	38	37.810	1.024	0	21	18.689
	2	20	41	12.818	0.929	3	18	14.615		17	23	42	34.365	1.032	0	17	22.780
	3	20	45	09.374	0.930	3	14	18.706		18	23	46	30.921	1.040	0	13	26.870
	4	20	49	05.929	0.935	3	10	22.796		19	23	50	27.476	1.045	0	09	30.961
	5	20	53	02.484	0.941	3	06	26.887		20	23	54	24.031	1.047	0	05	35.051
	6	20	56	59.040	-0.948	3	02	30.977		21	23	58	20.587	-1.047	0	01	39.142
	7	21	00	55.595	0.952	2	58	35.068		22	0	02	17.142	1.044	23	53	47.323
	8	21	04	52.151	0.954	2	54	39.159		23	0	06	13.698	1.040	23	49	51.414
	9	21	08	48.706	0.953	2	50	43.249		24	0	10	10.253	1.037	23	45	55.504
	10	21	12	45.261	0.950	2	46	47.340		25	0	14	06.808	1.035	23	41	59.595
	11	21	16	41.817	0.946	2	42	51.430		26	0	18	03.364	1.036	23	38	03.685
	12	21	20	38.372	-0.942	2	38	55.521		27	0	21	59.919	-1.040	23	34	07.776
	13	21	24	34.927	0.938	2	34	59.611		28	0	25	56.474	1.048	23	30	11.866
	14	21	28	31.483	0.936	2	31	03.702		29	0	29	53.030	1.057	23	26	15.957
	15	21	32	28.038	0.936	2	27	07.792		30	0	33	49.585	1.066	23	22	20.047
	16	21	36	24.594	-0.938	2	23	11.883	Oct.	1	0	37	46.140	-1.073	23	18	24.138

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

SIDEREAL TIME, 2019

Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinox-es at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)			Date		Mean Greenwich Sidereal Time at 0^h U.T. (G.H.A. of the Equinox)			Equation of the Equinox-es at 0^h U.T.	Greenwich Transit of Mean Equinox (U.T. at 0^h G.M.S.T.)		
		h	m	s	s	h	m	s			h	m	s	s	h	m	s
Oct.	1	0	37	46.140	-1.073	23	18	24.138	Nov.	16	3	39	07.687	-1.128	20	17	32.302
	2	0	41	42.696	1.076	23	14	28.228		17	3	43	04.243	1.120	20	13	36.393
	3	0	45	39.251	1.076	23	10	32.319		18	3	46	60.798	1.114	20	09	40.483
	4	0	49	35.807	1.073	23	06	36.409		19	3	50	57.354	1.109	20	05	44.574
	5	0	53	32.362	1.070	23	02	40.500		20	3	54	53.909	1.108	20	01	48.664
	6	0	57	28.917	1.067	22	58	44.590		21	3	58	50.464	1.110	19	57	52.755
	7	1	01	25.473	-1.066	22	54	48.681		22	4	02	47.020	-1.114	19	53	56.845
	8	1	05	22.028	1.066	22	50	52.772		23	4	06	43.575	1.119	19	50	00.936
	9	1	09	18.583	1.069	22	46	56.862		24	4	10	40.130	1.124	19	46	05.026
	10	1	13	15.139	1.074	22	43	00.953		25	4	14	36.686	1.125	19	42	09.117
	11	1	17	11.694	1.081	22	39	05.043		26	4	18	33.241	1.123	19	38	13.208
	12	1	21	08.250	1.089	22	35	09.134		27	4	22	29.796	1.118	19	34	17.298
	13	1	25	04.805	-1.098	22	31	13.224		28	4	26	26.352	-1.111	19	30	21.389
	14	1	29	01.360	1.106	22	27	17.315		29	4	30	22.907	1.102	19	26	25.479
	15	1	32	57.916	1.113	22	23	21.405		30	4	34	19.463	1.094	19	22	29.570
	16	1	36	54.471	1.117	22	19	25.496	Dec.	1	4	38	16.018	1.088	19	18	33.660
	17	1	40	51.026	1.120	22	15	29.586		2	4	42	12.573	1.084	19	14	37.751
	18	1	44	47.582	1.119	22	11	33.677		3	4	46	09.129	1.082	19	10	41.841
	19	1	48	44.137	-1.116	22	07	37.767		4	4	50	05.684	-1.083	19	06	45.932
	20	1	52	40.692	1.112	22	03	41.858		5	4	54	02.239	1.086	19	02	50.022
	21	1	56	37.248	1.107	21	59	45.948		6	4	57	58.795	1.090	18	58	54.113
	22	2	00	33.803	1.103	21	55	50.039		7	5	01	55.350	1.093	18	54	58.203
	23	2	04	30.359	1.102	21	51	54.129		8	5	05	51.906	1.096	18	51	02.294
	24	2	08	26.914	1.104	21	47	58.220		9	5	09	48.461	1.098	18	47	06.384
	25	2	12	23.469	-1.110	21	44	02.310		10	5	13	45.016	-1.097	18	43	10.475
	26	2	16	20.025	1.117	21	40	06.401		11	5	17	41.572	1.093	18	39	14.565
	27	2	20	16.580	1.125	21	36	10.492		12	5	21	38.127	1.086	18	35	18.656
	28	2	24	13.135	1.131	21	32	14.582		13	5	25	34.682	1.077	18	31	22.746
	29	2	28	09.691	1.134	21	28	18.673		14	5	29	31.238	1.067	18	27	26.837
	30	2	32	06.246	1.133	21	24	22.763		15	5	33	27.793	1.058	18	23	30.928
	31	2	36	02.802	-1.129	21	20	26.854		16	5	37	24.348	-1.051	18	19	35.018
Nov.	1	2	39	59.357	1.124	21	16	30.944		17	5	41	20.904	1.048	18	15	39.109
	2	2	43	55.912	1.118	21	12	35.035		18	5	45	17.459	1.047	18	11	43.199
	3	2	47	52.468	1.114	21	08	39.125		19	5	49	14.015	1.049	18	07	47.290
	4	2	51	49.023	1.111	21	04	43.216		20	5	53	10.570	1.053	18	03	51.380
	5	2	55	45.578	1.111	21	00	47.306		21	5	57	07.125	1.056	17	59	55.471
	6	2	59	42.134	-1.113	20	56	51.397		22	6	01	03.681	-1.057	17	55	59.561
	7	3	03	38.689	1.117	20	52	55.487		23	6	04	60.236	1.055	17	52	03.652
	8	3	07	35.244	1.122	20	48	59.578		24	6	08	56.791	1.050	17	48	07.742
	9	3	11	31.800	1.128	20	45	03.668		25	6	12	53.347	1.043	17	44	11.833
	10	3	15	28.355	1.134	20	41	07.759		26	6	16	49.902	1.033	17	40	15.923
	11	3	19	24.911	1.139	20	37	11.850		27	6	20	46.458	1.024	17	36	20.014
	12	3	23	21.466	-1.142	20	33	15.940		28	6	24	43.013	-1.016	17	32	24.104
	13	3	27	18.021	1.142	20	29	20.031		29	6	28	39.568	1.011	17	28	28.195
	14	3	31	14.577	1.140	20	25	24.121		30	6	32	36.124	1.008	17	24	32.285
	15	3	35	11.132	1.135	20	21	28.212		31	6	36	32.679	1.007	17	20	36.376
	16	3	39	07.687	-1.128	20	17	32.302	Dec	32	6	40	29.234	-1.009	17	16	40.467

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

SUN, 2019
MEAN LONGITUDE AND ANOMALY

Date		Horizontal Parallax	Mean Longitude			Mean Anomaly	Date		Horizontal Parallax	Mean Longitude			Mean Anomaly
		"	°	′	"	°			"	°	′	"	°
Jan.	1	8.94	280	21	58.685	357.102	July	10	8.65	107	38	21.479	184.366
	11	8.94	290	13	21.990	6.958		20	8.65	117	29	44.784	194.222
	21	8.94	300	04	45.295	16.814		30	8.66	127	21	08.089	204.078
	31	8.93	309	56	08.600	26.670	Aug.	9	8.67	137	12	31.394	213.934
Feb.	10	8.91	319	47	31.905	36.526		19	8.69	147	03	54.699	223.790
	20	8.90	329	38	55.210	46.382		29	8.71	156	55	18.004	233.646
Mar.	2	8.87	339	30	18.515	56.238	Sept.	8	8.73	166	46	41.309	243.502
	12	8.85	349	21	41.820	66.094		18	8.75	176	38	04.614	253.358
	22	8.83	359	13	05.125	75.950		28	8.77	186	29	27.919	263.214
Apr.	1	8.80	9	04	28.430	85.806	Oct.	8	8.80	196	20	51.224	273.070
	11	8.78	18	55	51.734	95.662		18	8.82	206	12	14.529	282.926
	21	8.75	28	47	15.039	105.518		28	8.85	216	03	37.834	292.782
May	1	8.73	38	38	38.344	115.374	Nov.	7	8.87	225	55	01.139	302.638
	11	8.71	48	30	01.649	125.230		17	8.89	235	46	24.444	312.494
	21	8.69	58	21	24.954	135.086		27	8.91	245	37	47.749	322.350
	31	8.67	68	12	48.259	144.942	Dec.	7	8.93	255	29	11.054	332.206
June	10	8.66	78	04	11.564	154.798		17	8.94	265	20	34.358	342.062
	20	8.65	87	55	34.869	164.654		27	8.94	275	11	57.663	351.918
	30	8.65	97	46	58.174	174.510		37	8.94	285	03	20.968	1.774
July	10	8.65	107	38	21.479	184.366		47	8.94	294	54	44.273	11.630

SUN, 2019

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date) °	'	"	Latitude (Ecliptic of date) "	Apparent Longitude (True equinox of date) °	'	"	Aberration "	Prec. in Long. (J 2019.5 of date) "	Nut. in Long. "	Nut. in Obliquity "	True Obliquity (23° 26') "
Jan.	0	279	14	46.70	+1.08	279	14	10.82	20.84	-25.53	-15.08	-4.69	7.82
	1	280	15	56.59	1.04	280	15	20.70	20.84	25.39	15.09	4.71	7.79
	2	281	17	06.86	1.01	281	16	31.01	20.84	25.25	15.06	4.74	7.77
	3	282	18	17.39	0.94	282	17	41.60	20.84	25.11	14.99	4.76	7.75
	4	283	19	28.10	0.83	283	18	52.42	20.84	24.97	14.89	4.77	7.74
	5	284	20	38.95	0.72	284	20	03.37	20.84	24.84	14.78	4.76	7.74
	6	285	21	49.79	+0.61	285	21	14.33	20.84	-24.70	-14.67	-4.74	7.76
	7	286	23	00.58	0.47	286	22	25.21	20.84	24.56	14.57	4.71	7.79
	8	287	24	11.18	0.32	287	23	35.88	20.84	24.42	14.50	4.66	7.84
	9	288	25	21.52	0.22	288	24	46.26	20.84	24.28	14.47	4.61	7.89
	10	289	26	31.54	+0.11	289	25	56.28	20.84	24.14	14.47	4.55	7.94
	11	290	27	41.16	-0.00	290	27	05.87	20.84	24.00	14.50	4.50	7.99
	12	291	28	50.26	-0.07	291	28	14.92	20.84	-23.86	-14.55	-4.46	8.03
	13	292	29	58.84	0.14	292	29	23.42	20.84	23.73	14.62	4.44	8.05
	14	293	31	06.80	0.14	293	30	31.32	20.84	23.59	14.69	4.43	8.06
	15	294	32	14.13	0.14	294	31	38.60	20.84	23.45	14.73	4.43	8.06
	16	295	33	20.70	0.11	295	32	45.17	20.84	23.31	14.74	4.44	8.04
	17	296	34	26.58	-0.04	296	33	51.08	20.84	23.17	14.71	4.46	8.02
	18	297	35	31.69	+0.07	297	34	56.28	20.83	-23.03	-14.62	-4.48	8.01
	19	298	36	36.03	0.18	298	36	00.76	20.83	22.89	14.49	4.48	8.01
	20	299	37	39.63	0.32	299	37	04.51	20.83	22.75	14.33	4.45	8.03
	21	300	38	42.52	0.47	300	38	07.55	20.83	22.61	14.19	4.40	8.08
	22	301	39	44.77	0.61	301	39	09.90	20.83	22.48	14.09	4.33	8.15
	23	302	40	46.40	0.76	302	40	11.57	20.83	22.34	14.05	4.25	8.23
	24	303	41	47.44	+0.86	303	41	12.59	20.82	-22.20	-14.08	-4.17	8.31
	25	304	42	47.96	0.94	304	42	13.03	20.82	22.06	14.15	4.12	8.36
	26	305	43	47.95	1.01	305	43	12.94	20.82	21.92	14.24	4.09	8.39
	27	306	44	47.42	1.04	306	44	12.34	20.82	21.78	14.32	4.08	8.39
	28	307	45	46.37	1.01	307	45	11.23	20.81	21.64	14.37	4.09	8.39
	29	308	46	44.69	0.97	308	46	09.55	20.81	21.50	14.38	4.10	8.37
	30	309	47	42.41	+0.90	309	47	07.30	20.81	-21.37	-14.35	-4.11	8.36
	31	310	48	39.37	0.83	310	48	04.32	20.80	21.23	14.29	4.11	8.36
Feb.	1	311	49	35.60	0.72	311	49	00.62	20.80	21.09	14.22	4.10	8.37
	2	312	50	31.00	0.58	312	49	56.10	20.80	20.95	14.15	4.07	8.39
	3	313	51	25.44	0.47	313	50	50.60	20.80	20.81	14.09	4.03	8.44
	4	314	52	18.93	0.32	314	51	44.14	20.79	20.67	14.05	3.98	8.49
	5	315	53	11.34	+0.18	315	52	36.55	20.79	-20.53	-14.04	-3.92	8.55
	6	316	54	02.56	+0.07	316	53	27.74	20.79	20.39	14.08	3.85	8.61
	7	317	54	52.55	-0.04	317	54	17.68	20.78	20.25	14.14	3.80	8.66
	8	318	55	41.24	0.11	318	55	06.28	20.78	20.12	14.23	3.75	8.71
	9	319	56	28.58	0.18	319	55	53.51	20.78	19.98	14.34	3.71	8.75
	10	320	57	14.40	0.22	320	56	39.23	20.77	19.84	14.45	3.69	8.76
	11	321	57	58.70	-0.22	321	57	23.44	20.77	-19.70	-14.55	-3.69	8.77
	12	322	58	41.47	0.18	322	58	06.13	20.76	19.56	14.62	3.69	8.76
	13	323	59	22.57	0.14	323	58	47.21	20.76	19.42	14.64	3.71	8.75
	14	325	00	01.96	-0.07	324	59	26.63	20.76	19.28	14.62	3.72	8.73
	15	326	00	39.66	+0.04	326	00	04.39	20.75	-19.14	-14.56	-3.72	8.73

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -16' 20".665 and subtract precession from J 2019.5.

SUN, 2019
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Jan.	0	18	40	12.12	-23	06	48.92	0.983 3228	16	15.92	12	02	57.50
	1	18	44	37.34	23	02	20.35	0.983 3113	16	15.93	12	03	26.04
	2	18	49	02.29	22	57	24.16	0.983 3042	16	15.94	12	03	54.28
	3	18	53	26.92	22	52	00.51	0.983 3013	16	15.94	12	04	22.19
	4	18	57	51.21	22	46	09.56	0.983 3024	16	15.94	12	04	49.74
	5	19	02	15.11	22	39	51.48	0.983 3074	16	15.94	12	05	16.88
	6	19	06	38.59	-22	33	06.46	0.983 3163	16	15.93	12	05	43.58
	7	19	11	01.63	22	25	54.69	0.983 3291	16	15.91	12	06	09.83
	8	19	15	24.18	22	18	16.38	0.983 3458	16	15.90	12	06	35.57
	9	19	19	46.22	22	10	11.76	0.983 3664	16	15.88	12	07	00.80
	10	19	24	07.72	22	01	41.05	0.983 3911	16	15.85	12	07	25.46
	11	19	28	28.65	21	52	44.51	0.983 4200	16	15.82	12	07	49.55
	12	19	32	48.99	-21	43	22.39	0.983 4532	16	15.79	12	08	13.03
	13	19	37	08.70	21	33	34.96	0.983 4910	16	15.75	12	08	35.89
	14	19	41	27.78	21	23	22.51	0.983 5334	16	15.71	12	08	58.09
	15	19	45	46.20	21	12	45.32	0.983 5808	16	15.66	12	09	19.62
	16	19	50	03.95	21	01	43.70	0.983 6334	16	15.61	12	09	40.46
	17	19	54	20.99	20	50	17.96	0.983 6915	16	15.55	12	10	00.59
	18	19	58	37.33	-20	38	28.45	0.983 7554	16	15.49	12	10	20.01
	19	20	02	52.94	20	26	15.48	0.983 8252	16	15.42	12	10	38.69
	20	20	07	07.81	20	13	39.41	0.983 9013	16	15.35	12	10	56.62
	21	20	11	21.94	20	00	40.59	0.983 9839	16	15.26	12	11	13.81
	22	20	15	35.31	19	47	19.35	0.984 0729	16	15.18	12	11	30.23
	23	20	19	47.92	19	33	36.03	0.984 1684	16	15.08	12	11	45.90
	24	20	23	59.76	-19	19	30.97	0.984 2702	16	14.98	12	12	00.80
	25	20	28	10.83	19	05	04.52	0.984 3779	16	14.87	12	12	14.92
	26	20	32	21.12	18	50	17.03	0.984 4913	16	14.76	12	12	28.28
	27	20	36	30.64	18	35	08.86	0.984 6101	16	14.64	12	12	40.85
	28	20	40	39.37	18	19	40.39	0.984 7338	16	14.52	12	12	52.63
	29	20	44	47.33	18	03	52.00	0.984 8621	16	14.40	12	13	03.63
	30	20	48	54.49	-17	47	44.10	0.984 9946	16	14.26	12	13	13.82
	31	20	53	00.85	17	31	17.07	0.985 1312	16	14.13	12	13	23.22
Feb.	1	20	57	06.41	17	14	31.34	0.985 2715	16	13.99	12	13	31.82
	2	21	01	11.17	16	57	27.29	0.985 4153	16	13.85	12	13	39.61
	3	21	05	15.13	16	40	05.36	0.985 5625	16	13.70	12	13	46.59
	4	21	09	18.27	16	22	25.95	0.985 7129	16	13.55	12	13	52.76
	5	21	13	20.60	-16	04	29.48	0.985 8664	16	13.40	12	13	58.12
	6	21	17	22.11	15	46	16.37	0.986 0230	16	13.25	12	14	02.67
	7	21	21	22.82	15	27	47.03	0.986 1827	16	13.09	12	14	06.42
	8	21	25	22.71	15	09	01.89	0.986 3454	16	12.93	12	14	09.35
	9	21	29	21.81	14	50	01.38	0.986 5111	16	12.77	12	14	11.49
	10	21	33	20.10	14	30	45.91	0.986 6801	16	12.60	12	14	12.82
	11	21	37	17.59	-14	11	15.90	0.986 8524	16	12.43	12	14	13.37
	12	21	41	14.31	13	51	31.80	0.987 0281	16	12.26	12	14	13.13
	13	21	45	10.24	13	31	34.01	0.987 2074	16	12.08	12	14	12.12
	14	21	49	05.40	13	11	22.98	0.987 3906	16	11.90	12	14	10.34
	15	21	52	59.81	-12	50	59.13	0.987 5779	16	11.72	12	14	07.80

SUN, 2019

FOR 0^h TERRESTRIAL TIME

Date	Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberration	Prec. in Long. (J 2019.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
	°	'	"	"	°	'	"	"	"	"	"	"
Feb. 15	326	00	39.66	+0.04	326	00	04.39	20.75	-19.14	-14.56	-3.72	8.73
16	327	01	15.63	0.18	327	00	40.46	20.75	19.01	14.46	3.71	8.74
17	328	01	49.90	0.29	328	01	14.84	20.75	18.87	14.36	3.67	8.78
18	329	02	22.47	0.43	329	01	47.50	20.74	18.73	14.28	3.60	8.84
19	330	02	53.37	0.58	330	02	18.42	20.74	18.59	14.26	3.53	8.92
20	331	03	22.68	0.68	331	02	47.69	20.73	18.45	14.30	3.45	9.00
21	332	03	50.46	+0.79	332	03	15.37	20.73	-18.31	-14.40	-3.38	9.06
22	333	04	16.72	0.86	333	03	41.51	20.72	18.17	14.53	3.35	9.09
23	334	04	41.58	0.90	334	04	06.24	20.72	18.03	14.66	3.33	9.11
24	335	05	05.04	0.90	335	04	29.60	20.71	17.89	14.77	3.34	9.10
25	336	05	27.13	0.86	336	04	51.64	20.71	17.76	14.83	3.36	9.08
26	337	05	47.81	0.79	337	05	12.30	20.70	17.62	14.85	3.38	9.06
27	338	06	07.08	+0.72	338	05	31.60	20.70	-17.48	-14.84	-3.39	9.04
28	339	06	24.90	0.61	339	05	49.45	20.69	17.34	14.80	3.39	9.04
Mar. 1	340	06	41.28	0.50	340	06	05.87	20.69	17.20	14.77	3.37	9.06
2	341	06	56.11	0.36	341	06	20.74	20.68	17.06	14.74	3.34	9.09
3	342	07	09.35	0.22	342	06	33.98	20.68	16.92	14.73	3.30	9.13
4	343	07	21.00	+0.11	343	06	45.61	20.67	16.78	14.76	3.25	9.18
5	344	07	30.95	-0.04	344	06	55.51	20.67	-16.65	-14.82	-3.20	9.23
6	345	07	39.14	0.11	345	07	03.61	20.66	16.51	14.91	3.15	9.28
7	346	07	45.56	0.22	346	07	09.91	20.66	16.37	15.04	3.11	9.32
8	347	07	50.05	0.29	347	07	14.27	20.65	16.23	15.18	3.08	9.34
9	348	07	52.64	0.32	348	07	16.72	20.65	16.09	15.32	3.07	9.35
10	349	07	53.20	0.32	349	07	17.15	20.64	15.95	15.46	3.07	9.35
11	350	07	51.68	-0.32	350	07	15.53	20.64	-15.81	-15.56	-3.09	9.33
12	351	07	48.08	0.29	351	07	11.86	20.63	15.67	15.64	3.11	9.30
13	352	07	42.26	0.22	352	07	06.02	20.62	15.53	15.66	3.14	9.28
14	353	07	34.25	-0.11	353	06	58.03	20.62	15.40	15.64	3.16	9.26
15	354	07	23.97	+0.00	354	06	47.81	20.61	15.26	15.59	3.17	9.25
16	355	07	11.44	0.14	355	06	35.35	20.61	15.12	15.52	3.15	9.26
17	356	06	56.62	+0.25	356	06	20.59	20.60	-14.98	-15.47	-3.11	9.30
18	357	06	39.53	0.40	357	06	03.53	20.60	14.84	15.45	3.06	9.35
19	358	06	20.23	0.50	358	05	44.20	20.59	14.70	15.49	2.99	9.41
20	359	05	58.80	0.61	359	05	22.67	20.59	14.56	15.59	2.94	9.47
21	0	05	35.24	0.68	0	04	58.98	20.58	14.42	15.73	2.91	9.50
22	1	05	09.69	0.72	1	04	33.28	20.57	14.28	15.88	2.90	9.51
23	2	04	42.17	+0.72	2	04	05.63	20.57	-14.15	-16.02	-2.92	9.49
24	3	04	12.81	0.72	3	03	36.18	20.56	14.01	16.11	2.95	9.45
25	4	03	41.60	0.65	4	03	04.93	20.56	13.87	16.16	2.99	9.41
26	5	03	08.59	0.58	5	02	31.92	20.55	13.73	16.16	3.02	9.38
27	6	02	33.82	0.47	6	01	57.18	20.54	13.59	16.14	3.05	9.35
28	7	01	57.27	0.36	7	01	20.68	20.54	13.45	16.10	3.05	9.34
29	8	01	18.97	+0.22	8	00	42.41	20.53	-13.31	-16.08	-3.04	9.35
30	9	00	38.89	+0.11	9	00	02.34	20.53	13.17	16.07	3.02	9.37
31	9	59	57.04	-0.04	9	59	20.47	20.52	13.04	16.09	2.99	9.40
Apr. 1	10	59	13.34	0.14	10	58	36.73	20.51	12.90	16.14	2.96	9.44
2	11	58	27.78	-0.25	11	57	51.08	20.51	-12.76	-16.23	-2.92	9.47

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -16' 20".665 and subtract precession from J 2019.5.

SUN, 2019
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Feb.	15	21	52	59.81	-12	50	59.13	0.987 5779	16	11.72	12	14	07.80
	16	21	56	53.48	12	30	22.89	0.987 7696	16	11.53	12	14	04.53
	17	22	00	46.40	12	09	34.69	0.987 9659	16	11.33	12	14	00.53
	18	22	04	38.61	11	48	34.94	0.988 1670	16	11.14	12	13	55.82
	19	22	08	30.12	11	27	24.04	0.988 3731	16	10.93	12	13	50.42
	20	22	12	20.94	11	06	02.40	0.988 5843	16	10.73	12	13	44.35
	21	22	16	11.10	-10	44	30.38	0.988 8005	16	10.51	12	13	37.62
	22	22	20	00.61	10	22	48.37	0.989 0216	16	10.30	12	13	30.27
	23	22	23	49.50	10	00	56.74	0.989 2472	16	10.08	12	13	22.30
	24	22	27	37.79	9	38	55.86	0.989 4771	16	09.85	12	13	13.74
	25	22	31	25.49	9	16	46.14	0.989 7108	16	09.62	12	13	04.61
	26	22	35	12.63	8	54	27.96	0.989 9479	16	09.39	12	12	54.91
	27	22	38	59.23	-8	32	01.73	0.990 1882	16	09.15	12	12	44.68
	28	22	42	45.29	8	09	27.85	0.990 4312	16	08.92	12	12	33.92
Mar.	1	22	46	30.83	7	46	46.73	0.990 6766	16	08.68	12	12	22.65
	2	22	50	15.87	7	23	58.78	0.990 9242	16	08.43	12	12	10.89
	3	22	54	00.43	7	01	04.39	0.991 1737	16	08.19	12	11	58.64
	4	22	57	44.51	6	38	03.98	0.991 4248	16	07.95	12	11	45.94
	5	23	01	28.13	-6	14	57.95	0.991 6773	16	07.70	12	11	32.79
	6	23	05	11.32	5	51	46.69	0.991 9312	16	07.45	12	11	19.22
	7	23	08	54.08	5	28	30.61	0.992 1861	16	07.20	12	11	05.22
	8	23	12	36.44	5	05	10.12	0.992 4422	16	06.95	12	10	50.84
	9	23	16	18.40	4	41	45.60	0.992 6992	16	06.70	12	10	36.07
	10	23	19	60.00	4	18	17.45	0.992 9572	16	06.45	12	10	20.93
	11	23	23	41.24	-3	54	46.07	0.993 2162	16	06.20	12	10	05.45
	12	23	27	22.14	3	31	11.85	0.993 4763	16	05.95	12	09	49.64
	13	23	31	02.73	3	07	35.19	0.993 7376	16	05.69	12	09	33.52
	14	23	34	43.01	2	43	56.49	0.994 0003	16	05.44	12	09	17.11
	15	23	38	23.02	2	20	16.12	0.994 2646	16	05.18	12	09	00.42
	16	23	42	02.76	1	56	34.49	0.994 5306	16	04.92	12	08	43.48
	17	23	45	42.26	-1	32	51.98	0.994 7988	16	04.66	12	08	26.31
	18	23	49	21.54	-1	09	08.97	0.995 0692	16	04.40	12	08	08.94
	19	23	53	00.61	+0	45	25.81	0.995 3422	16	04.14	12	07	51.38
	20	23	56	39.52	0	21	42.86	0.995 6179	16	03.87	12	07	33.65
	21	0	00	18.27	0	01	59.54	0.995 8963	16	03.60	12	07	15.80
	22	0	03	56.90	0	25	41.09	0.996 1775	16	03.33	12	06	57.84
	23	0	07	35.44	+0	49	21.44	0.996 4612	16	03.05	12	06	39.79
	24	0	11	13.91	1	13	00.29	0.996 7473	16	02.78	12	06	21.69
	25	0	14	52.33	1	36	37.30	0.997 0354	16	02.50	12	06	03.55
	26	0	18	30.74	2	00	12.13	0.997 3251	16	02.22	12	05	45.40
	27	0	22	09.14	2	23	44.43	0.997 6161	16	01.94	12	05	27.25
	28	0	25	47.56	2	47	13.85	0.997 9080	16	01.66	12	05	09.14
	29	0	29	26.01	+3	10	40.03	0.998 2005	16	01.37	12	04	51.07
	30	0	33	04.53	3	34	02.62	0.998 4932	16	01.09	12	04	33.06
	31	0	36	43.11	3	57	21.27	0.998 7859	16	00.81	12	04	15.14
Apr.	1	0	40	21.78	4	20	35.61	0.999 0782	16	00.53	12	03	57.32
	2	0	44	00.57	+4	43	45.28	0.999 3698	16	00.25	12	03	39.61

SUN, 2019

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberration	Prec. in Long. (J 2019.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
Apr.	1	10	59	13.34	-0.14	10	58	36.73	20.51	-12.90	-16.14	-2.96	9.44
	2	11	58	27.78	0.25	11	57	51.08	20.51	12.76	16.23	2.92	9.47
	3	12	57	40.37	0.32	12	57	03.56	20.50	12.62	16.35	2.90	9.49
	4	13	56	51.00	0.40	13	56	14.06	20.50	12.48	16.48	2.88	9.50
	5	14	55	59.69	0.43	14	55	22.62	20.49	12.34	16.63	2.89	9.50
	6	15	55	06.36	0.47	15	54	29.16	20.48	12.20	16.76	2.90	9.48
	7	16	54	10.96	-0.43	16	53	33.65	20.48	-12.06	-16.88	-2.94	9.45
	8	17	53	13.43	0.40	17	52	36.05	20.47	11.92	16.95	2.98	9.40
	9	18	52	13.72	0.32	18	51	36.32	20.47	11.79	16.98	3.02	9.36
	10	19	51	11.82	0.25	19	50	34.44	20.46	11.65	16.96	3.06	9.32
	11	20	50	07.64	0.14	20	49	30.32	20.46	11.51	16.91	3.09	9.29
	12	21	49	01.18	-0.00	21	48	23.94	20.45	11.37	16.83	3.10	9.28
	13	22	47	52.42	+0.11	22	47	15.25	20.44	-11.23	-16.77	-3.08	9.29
	14	23	46	41.35	0.25	23	46	04.22	20.44	11.09	16.73	3.05	9.33
	15	24	45	27.95	0.36	24	44	50.82	20.43	10.95	16.74	3.01	9.37
	16	25	44	12.33	0.43	25	43	35.15	20.43	10.81	16.80	2.97	9.41
	17	26	42	54.46	0.50	26	42	17.17	20.42	10.67	16.91	2.94	9.43
	18	27	41	34.49	0.58	27	40	57.07	20.42	10.54	17.05	2.94	9.43
	19	28	40	12.42	+0.58	28	39	34.88	20.41	-10.40	-17.17	-2.96	9.41
	20	29	38	48.38	0.58	29	38	10.75	20.41	10.26	17.26	3.01	9.36
	21	30	37	22.45	0.50	30	36	44.78	20.40	10.12	17.31	3.06	9.31
	22	31	35	54.70	0.43	31	35	17.05	20.39	9.98	17.30	3.11	9.25
	23	32	34	25.23	0.32	32	33	47.63	20.39	9.84	17.26	3.15	9.21
	24	33	32	54.08	0.22	33	32	16.55	20.38	9.70	17.19	3.18	9.18
	25	34	31	21.27	+0.07	34	30	43.81	20.38	-9.56	-17.13	-3.19	9.17
	26	35	29	46.83	-0.04	35	29	09.42	20.37	9.43	17.08	3.18	9.18
	27	36	28	10.82	0.18	36	27	33.44	20.37	9.29	17.06	3.17	9.19
	28	37	26	33.23	0.29	37	25	55.85	20.36	9.15	17.07	3.14	9.22
	29	38	24	54.10	0.40	38	24	16.67	20.36	9.01	17.12	3.12	9.24
	30	39	23	13.37	0.47	39	22	35.87	20.35	8.87	17.19	3.10	9.26
May	1	40	21	31.08	-0.54	40	20	53.48	20.34	-8.73	-17.29	-3.09	9.26
	2	41	19	47.18	0.61	41	19	09.48	20.34	8.59	17.41	3.10	9.26
	3	42	18	01.70	0.61	42	17	23.89	20.33	8.45	17.51	3.12	9.23
	4	43	16	14.57	0.61	43	15	36.68	20.33	8.31	17.60	3.16	9.19
	5	44	14	25.79	0.58	44	13	47.86	20.32	8.18	17.65	3.21	9.14
	6	45	12	35.30	0.50	45	11	57.37	20.32	8.04	17.66	3.26	9.09
	7	46	10	43.04	-0.40	46	10	05.16	20.31	-7.90	-17.61	-3.31	9.04
	8	47	08	49.01	0.29	47	08	11.22	20.31	7.76	17.52	3.35	9.00
	9	48	06	53.12	0.18	48	06	15.44	20.31	7.62	17.41	3.36	8.98
	10	49	04	55.39	-0.04	49	04	17.83	20.30	7.48	17.30	3.36	8.98
	11	50	02	55.78	+0.07	50	02	18.31	20.30	7.34	17.22	3.33	9.01
	12	51	00	54.24	0.18	51	00	16.81	20.29	7.20	17.18	3.30	9.04
	13	51	58	50.84	+0.29	51	58	13.40	20.29	-7.06	-17.20	-3.26	9.08
	14	52	56	45.62	0.36	52	56	08.12	20.28	6.93	17.26	3.23	9.10
	15	53	54	38.56	0.43	53	54	00.97	20.28	6.79	17.35	3.23	9.11
	16	54	52	29.77	0.43	54	51	52.09	20.27	6.65	17.44	3.24	9.09
	17	55	50	19.29	+0.43	55	49	41.56	20.27	-6.51	-17.51	-3.28	9.05

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -16' 20".665 and subtract precession from J 2019.5.

SUN, 2019

FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Apr.	1	0	40	21.78	+4	20	35.61	0.999 0782	16	00.53	12	03	57.32
	2	0	44	00.57	4	43	45.28	0.999 3698	16	00.25	12	03	39.61
	3	0	47	39.47	5	06	49.93	0.999 6606	15	59.97	12	03	22.05
	4	0	51	18.52	5	29	49.19	0.999 9503	15	59.69	12	03	04.63
	5	0	54	57.73	5	52	42.72	1.000 2387	15	59.42	12	02	47.38
	6	0	58	37.12	6	15	30.14	1.000 5257	15	59.14	12	02	30.32
	7	1	02	16.69	+6	38	11.11	1.000 8112	15	58.87	12	02	13.45
	8	1	05	56.47	7	00	45.26	1.001 0951	15	58.60	12	01	56.79
	9	1	09	36.48	7	23	12.22	1.001 3774	15	58.32	12	01	40.36
	10	1	13	16.72	7	45	31.65	1.001 6583	15	58.06	12	01	24.17
	11	1	16	57.21	8	07	43.17	1.001 9377	15	57.79	12	01	08.23
	12	1	20	37.96	8	29	46.43	1.002 2160	15	57.52	12	00	52.56
	13	1	24	18.99	+8	51	41.05	1.002 4932	15	57.26	12	00	37.18
	14	1	28	00.31	9	13	26.70	1.002 7697	15	56.99	12	00	22.10
	15	1	31	41.94	9	35	03.00	1.003 0457	15	56.73	12	00	07.34
	16	1	35	23.89	9	56	29.64	1.003 3214	15	56.47	11	59	52.91
	17	1	39	06.18	10	17	46.27	1.003 5972	15	56.21	11	59	38.84
	18	1	42	48.84	10	38	52.59	1.003 8731	15	55.94	11	59	25.14
	19	1	46	31.88	+10	59	48.29	1.004 1492	15	55.68	11	59	11.83
	20	1	50	15.32	11	20	33.09	1.004 4256	15	55.42	11	58	58.93
	21	1	53	59.19	11	41	06.68	1.004 7021	15	55.15	11	58	46.46
	22	1	57	43.49	12	01	28.76	1.004 9785	15	54.89	11	58	34.43
	23	2	01	28.25	12	21	39.03	1.005 2545	15	54.63	11	58	22.87
	24	2	05	13.48	12	41	37.18	1.005 5299	15	54.37	11	58	11.78
	25	2	08	59.19	+13	01	22.87	1.005 8043	15	54.11	11	58	01.18
	26	2	12	45.40	13	20	55.80	1.006 0774	15	53.85	11	57	51.07
	27	2	16	32.10	13	40	15.63	1.006 3489	15	53.59	11	57	41.48
	28	2	20	19.32	13	59	22.04	1.006 6185	15	53.34	11	57	32.41
	29	2	24	07.06	14	18	14.70	1.006 8858	15	53.08	11	57	23.86
	30	2	27	55.33	14	36	53.28	1.007 1505	15	52.83	11	57	15.85
May	1	2	31	44.14	+14	55	17.46	1.007 4124	15	52.58	11	57	08.38
	2	2	35	33.50	15	13	26.91	1.007 6713	15	52.34	11	57	01.46
	3	2	39	23.40	15	31	21.31	1.007 9267	15	52.10	11	56	55.09
	4	2	43	13.86	15	49	00.32	1.008 1786	15	51.86	11	56	49.27
	5	2	47	04.87	16	06	23.64	1.008 4268	15	51.63	11	56	44.01
	6	2	50	56.45	16	23	30.93	1.008 6711	15	51.40	11	56	39.31
	7	2	54	48.58	+16	40	21.86	1.008 9115	15	51.17	11	56	35.16
	8	2	58	41.28	16	56	56.13	1.009 1480	15	50.95	11	56	31.58
	9	3	02	34.53	17	13	13.40	1.009 3806	15	50.73	11	56	28.54
	10	3	06	28.34	17	29	13.35	1.009 6095	15	50.51	11	56	26.06
	11	3	10	22.69	17	44	55.66	1.009 8348	15	50.30	11	56	24.14
	12	3	14	17.60	18	00	20.02	1.010 0570	15	50.09	11	56	22.76
	13	3	18	13.06	+18	15	26.12	1.010 2761	15	49.88	11	56	21.93
	14	3	22	09.06	18	30	13.67	1.010 4925	15	49.68	11	56	21.66
	15	3	26	05.61	18	44	42.38	1.010 7065	15	49.48	11	56	21.93
	16	3	30	02.71	18	58	51.99	1.010 9184	15	49.28	11	56	22.76
	17	3	34	00.37	+19	12	42.25	1.011 1282	15	49.08	11	56	24.14

SUN, 2019

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberra-tion	Prec. in Long. (J 2019.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
May	17	55	50	19.29	+0.43	55	49	41.56	20.27	-6.51	-17.51	-3.28	9.05
	18	56	48	07.27	0.40	56	47	29.51	20.27	6.37	17.54	3.33	9.00
	19	57	45	53.71	0.29	57	45	15.98	20.26	6.23	17.51	3.39	8.94
	20	58	43	38.78	0.22	58	43	01.13	20.26	6.09	17.44	3.43	8.90
	21	59	41	22.57	+0.11	59	40	45.01	20.25	5.95	17.34	3.47	8.86
	22	60	39	05.08	-0.04	60	38	27.64	20.25	5.82	17.24	3.48	8.85
	23	61	36	46.45	-0.18	61	36	09.11	20.25	-5.68	-17.14	-3.48	8.85
	24	62	34	26.73	0.29	62	33	49.46	20.24	5.54	17.07	3.46	8.87
	25	63	32	05.92	0.43	63	31	28.70	20.24	5.40	17.03	3.43	8.89
	26	64	29	44.15	0.54	64	29	06.94	20.23	5.26	17.02	3.40	8.92
	27	65	27	21.40	0.61	65	26	44.16	20.23	5.12	17.05	3.38	8.94
	28	66	24	57.70	0.68	66	24	20.41	20.23	4.98	17.11	3.36	8.96
	29	67	22	33.09	-0.76	67	21	55.73	20.22	-4.84	-17.18	-3.35	8.96
	30	68	20	07.54	0.76	68	19	30.11	20.22	4.70	17.26	3.36	8.95
	31	69	17	41.12	0.76	69	17	03.62	20.22	4.57	17.32	3.39	8.93
June	1	70	15	13.76	0.72	70	14	36.24	20.21	4.43	17.35	3.43	8.89
	2	71	12	45.50	0.65	71	12	07.99	20.21	4.29	17.34	3.47	8.84
	3	72	10	16.28	0.58	72	09	38.84	20.21	4.15	17.27	3.52	8.79
	4	73	07	46.08	-0.47	73	07	08.76	20.20	-4.01	-17.16	-3.55	8.76
	5	74	05	14.84	0.32	74	04	37.67	20.20	3.87	17.02	3.57	8.74
	6	75	02	42.59	0.22	75	02	05.57	20.20	3.73	16.87	3.56	8.75
	7	76	00	09.20	-0.07	75	59	32.32	20.20	3.59	16.74	3.53	8.78
	8	76	57	34.68	+0.04	76	56	57.88	20.19	3.45	16.65	3.48	8.82
	9	77	54	59.02	0.14	77	54	22.25	20.19	3.32	16.63	3.43	8.87
	10	78	52	22.23	+0.25	78	51	45.43	20.19	-3.18	-16.65	-3.39	8.91
	11	79	49	44.32	0.29	79	49	07.46	20.19	3.04	16.71	3.37	8.93
	12	80	47	05.33	0.32	80	46	28.42	20.18	2.90	16.78	3.37	8.93
	13	81	44	25.29	0.32	81	43	48.32	20.18	2.76	16.83	3.38	8.91
	14	82	41	44.32	0.29	82	41	07.33	20.18	2.62	16.85	3.42	8.88
	15	83	39	02.46	0.22	83	38	25.51	20.18	2.48	16.82	3.46	8.84
	16	84	36	19.77	+0.11	84	35	42.90	20.18	-2.34	-16.74	-3.50	8.80
	17	85	33	36.40	+0.00	85	32	59.64	20.18	2.20	16.63	3.52	8.77
	18	86	30	52.44	-0.11	86	30	15.80	20.17	2.07	16.51	3.53	8.77
	19	87	28	07.90	0.25	87	27	31.39	20.17	1.93	16.39	3.51	8.78
	20	88	25	22.96	0.40	88	24	46.55	20.17	1.79	16.28	3.49	8.80
	21	89	22	37.65	0.50	89	22	01.31	20.17	1.65	16.21	3.45	8.84
	22	90	19	52.05	-0.65	90	19	15.74	20.17	-1.51	-16.18	-3.40	8.88
	23	91	17	06.20	0.72	91	16	29.89	20.17	1.37	16.19	3.36	8.93
	24	92	14	20.20	0.79	92	13	43.86	20.16	1.23	16.22	3.32	8.96
	25	93	11	34.08	0.86	93	10	57.68	20.16	1.09	16.28	3.30	8.99
	26	94	08	47.86	0.90	94	08	11.40	20.16	0.95	16.34	3.29	9.00
	27	95	06	01.60	0.90	95	05	25.08	20.16	0.82	16.40	3.29	8.99
	28	96	03	15.31	-0.86	96	02	38.76	20.16	-0.68	-16.44	-3.31	8.97
	29	97	00	29.03	0.79	96	59	52.48	20.16	0.54	16.43	3.33	8.94
	30	97	57	42.73	0.72	97	57	06.23	20.16	0.40	16.38	3.36	8.91
July	1	98	54	56.45	0.61	98	54	20.05	20.16	0.26	16.28	3.39	8.89
	2	99	52	10.13	-0.50	99	51	33.88	20.16	-0.12	-16.14	-3.39	8.88

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -16' 20".665 and subtract precession from J 2019.5.

SUN, 2019
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
May	17	3	34	00.37	+19	12	42.25	1.011 1282	15	49.08	11	56	24.14
	18	3	37	58.58	19	26	12.91	1.011 3361	15	48.89	11	56	26.07
	19	3	41	57.35	19	39	23.75	1.011 5421	15	48.69	11	56	28.56
	20	3	45	56.67	19	52	14.52	1.011 7462	15	48.50	11	56	31.59
	21	3	49	56.54	20	04	44.98	1.011 9482	15	48.31	11	56	35.17
	22	3	53	56.95	20	16	54.90	1.012 1479	15	48.13	11	56	39.29
	23	3	57	57.91	+20	28	44.04	1.012 3451	15	47.94	11	56	43.95
	24	4	01	59.39	20	40	12.17	1.012 5396	15	47.76	11	56	49.14
	25	4	06	01.40	20	51	19.04	1.012 7311	15	47.58	11	56	54.85
	26	4	10	03.93	21	02	04.43	1.012 9192	15	47.40	11	57	01.07
	27	4	14	06.95	21	12	28.11	1.013 1038	15	47.23	11	57	07.79
	28	4	18	10.47	21	22	29.87	1.013 2845	15	47.06	11	57	15.00
	29	4	22	14.47	+21	32	09.47	1.013 4610	15	46.90	11	57	22.69
	30	4	26	18.94	21	41	26.73	1.013 6332	15	46.74	11	57	30.83
	31	4	30	23.85	21	50	21.42	1.013 8006	15	46.58	11	57	39.41
June	1	4	34	29.21	21	58	53.36	1.013 9630	15	46.43	11	57	48.42
	2	4	38	34.98	22	07	02.37	1.014 1202	15	46.28	11	57	57.84
	3	4	42	41.15	22	14	48.25	1.014 2720	15	46.14	11	58	07.64
	4	4	46	47.70	+22	22	10.84	1.014 4183	15	46.00	11	58	17.80
	5	4	50	54.60	22	29	09.97	1.014 5590	15	45.87	11	58	28.31
	6	4	55	01.82	22	35	45.48	1.014 6941	15	45.75	11	58	39.13
	7	4	59	09.35	22	41	57.20	1.014 8236	15	45.63	11	58	50.24
	8	5	03	17.16	22	47	44.99	1.014 9479	15	45.51	11	59	01.62
	9	5	07	25.22	22	53	08.70	1.015 0671	15	45.40	11	59	13.24
	10	5	11	33.51	+22	58	08.20	1.015 1815	15	45.29	11	59	25.09
	11	5	15	42.02	23	02	43.37	1.015 2915	15	45.19	11	59	37.14
	12	5	19	50.71	23	06	54.13	1.015 3974	15	45.09	11	59	49.37
	13	5	23	59.57	23	10	40.38	1.015 4994	15	45.00	12	00	01.77
	14	5	28	08.59	23	14	02.07	1.015 5978	15	44.91	12	00	14.30
	15	5	32	17.75	23	16	59.15	1.015 6928	15	44.82	12	00	26.96
	16	5	36	27.02	+23	19	31.57	1.015 7846	15	44.73	12	00	39.73
	17	5	40	36.39	23	21	39.30	1.015 8732	15	44.65	12	00	52.58
	18	5	44	45.84	23	23	22.32	1.015 9586	15	44.57	12	01	05.49
	19	5	48	55.34	23	24	40.60	1.016 0407	15	44.49	12	01	18.45
	20	5	53	04.88	23	25	34.12	1.016 1195	15	44.42	12	01	31.44
	21	5	57	14.43	23	26	02.87	1.016 1947	15	44.35	12	01	44.44
	22	6	01	23.98	+23	26	06.85	1.016 2663	15	44.28	12	01	57.42
	23	6	05	33.50	23	25	46.06	1.016 3340	15	44.22	12	02	10.36
	24	6	09	42.96	23	25	00.51	1.016 3975	15	44.16	12	02	23.25
	25	6	13	52.36	23	23	50.23	1.016 4567	15	44.11	12	02	36.05
	26	6	18	01.66	23	22	15.25	1.016 5113	15	44.06	12	02	48.75
	27	6	22	10.85	23	20	15.60	1.016 5610	15	44.01	12	03	01.32
	28	6	26	19.91	+23	17	51.34	1.016 6056	15	43.97	12	03	13.75
	29	6	30	28.80	23	15	02.54	1.016 6448	15	43.93	12	03	25.99
	30	6	34	37.51	23	11	49.27	1.016 6783	15	43.90	12	03	38.04
July	1	6	38	46.00	23	08	11.61	1.016 7060	15	43.88	12	03	49.86
	2	6	42	54.27	+23	04	09.68	1.016 7275	15	43.86	12	04	01.44

SUN, 2019

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberration	Prec. in Long. (J 2019.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
July	1	98	54	56.45	-0.61	98	54	20.05	20.16	-0.26	-16.28	-3.39	8.89
	2	99	52	10.13	0.50	99	51	33.88	20.16	-0.12	16.14	3.39	8.88
	3	100	49	23.76	0.36	100	48	47.66	20.16	+0.02	15.98	3.38	8.89
	4	101	46	37.25	0.22	101	46	01.31	20.16	0.16	15.83	3.34	8.93
	5	102	43	50.64	-0.07	102	43	14.81	20.16	0.30	15.72	3.28	8.99
	6	103	41	03.84	+0.04	103	40	28.06	20.16	0.43	15.68	3.21	9.06
	7	104	38	16.82	+0.11	104	37	41.02	20.16	+0.57	-15.69	-3.14	9.12
	8	105	35	29.58	0.18	105	34	53.72	20.16	0.71	15.74	3.10	9.17
	9	106	32	42.11	0.22	106	32	06.18	20.16	0.85	15.82	3.07	9.19
	10	107	29	54.45	0.22	107	29	18.46	20.16	0.99	15.88	3.07	9.19
	11	108	27	06.62	0.22	108	26	30.59	20.16	1.13	15.92	3.09	9.18
	12	109	24	18.70	0.14	109	23	42.68	20.16	1.27	15.90	3.11	9.15
	13	110	21	30.71	+0.07	110	20	54.74	20.16	+1.41	-15.85	-3.13	9.13
	14	111	18	42.76	-0.04	111	18	06.88	20.16	1.54	15.76	3.14	9.12
	15	112	15	54.93	0.18	112	15	19.15	20.16	1.68	15.66	3.14	9.12
	16	113	13	07.31	0.29	113	12	31.64	20.16	1.82	15.55	3.12	9.14
	17	114	10	19.96	0.43	114	09	44.39	20.16	1.96	15.45	3.08	9.18
	18	115	07	32.97	0.58	115	06	57.46	20.17	2.10	15.39	3.03	9.23
	19	116	04	46.44	-0.68	116	04	10.96	20.17	+2.24	-15.36	-2.97	9.28
	20	117	02	00.46	0.79	117	01	24.96	20.17	2.38	15.37	2.91	9.34
	21	117	59	15.08	0.86	117	58	39.54	20.17	2.52	15.42	2.86	9.39
	22	118	56	30.35	0.94	118	55	54.73	20.17	2.66	15.49	2.81	9.44
	23	119	53	46.38	0.97	119	53	10.68	20.17	2.79	15.57	2.78	9.46
	24	120	51	03.17	0.97	120	50	27.38	20.17	2.93	15.66	2.77	9.48
	25	121	48	20.84	-0.94	121	47	44.99	20.18	+3.07	-15.72	-2.77	9.48
	26	122	45	39.39	0.90	122	45	03.49	20.18	3.21	15.76	2.78	9.47
	27	123	42	58.86	0.83	123	42	22.97	20.18	3.35	15.76	2.79	9.45
	28	124	40	19.26	0.72	124	39	43.42	20.18	3.49	15.70	2.81	9.43
	29	125	37	40.62	0.61	125	37	04.87	20.18	3.63	15.61	2.81	9.43
	30	126	35	02.92	0.47	126	34	27.30	20.19	3.77	15.48	2.79	9.44
	31	127	32	26.15	-0.32	127	31	50.66	20.19	+3.91	-15.35	-2.75	9.48
Aug.	1	128	29	50.24	0.18	128	29	14.86	20.19	4.04	15.24	2.69	9.55
	2	129	27	15.22	-0.07	129	26	39.88	20.19	4.18	15.19	2.61	9.63
	3	130	24	40.98	+0.04	130	24	05.62	20.20	4.32	15.21	2.53	9.71
	4	131	22	07.48	0.11	131	21	32.04	20.20	4.46	15.29	2.46	9.77
	5	132	19	34.66	0.14	132	18	59.11	20.20	4.60	15.39	2.42	9.81
	6	133	17	02.56	+0.18	133	16	26.90	20.20	+4.74	-15.49	-2.41	9.82
	7	134	14	31.11	0.14	134	13	55.38	20.21	4.88	15.57	2.41	9.82
	8	135	12	00.38	0.11	135	11	24.61	20.21	5.02	15.60	2.43	9.80
	9	136	09	30.39	+0.04	136	08	54.64	20.21	5.16	15.59	2.44	9.78
	10	137	07	01.16	-0.07	137	06	25.45	20.22	5.29	15.54	2.45	9.78
	11	138	04	32.78	0.18	138	03	57.13	20.22	5.43	15.47	2.44	9.78
	12	139	02	05.32	-0.29	139	01	29.75	20.22	+5.57	-15.40	-2.42	9.80
	13	139	59	38.82	0.43	139	59	03.30	20.23	5.71	15.34	2.38	9.84
	14	140	57	13.35	0.54	140	56	37.86	20.23	5.85	15.30	2.33	9.89
	15	141	54	49.02	0.68	141	54	13.54	20.23	5.99	15.30	2.27	9.95
	16	142	52	25.86	-0.79	142	51	50.33	20.24	+6.13	-15.34	-2.20	10.01

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -16' 20".665 and subtract precession from J 2019.5.

SUN, 2019
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
July	1	6	38	46.00	+23	08	11.61	1.016 7060	15	43.88	12	03	49.86
	2	6	42	54.27	23	04	09.68	1.016 7275	15	43.86	12	04	01.44
	3	6	47	02.27	22	59	43.56	1.016 7427	15	43.84	12	04	12.73
	4	6	51	09.98	22	54	53.39	1.016 7517	15	43.83	12	04	23.72
	5	6	55	17.37	22	49	39.27	1.016 7543	15	43.83	12	04	34.38
	6	6	59	24.41	22	44	01.32	1.016 7508	15	43.83	12	04	44.68
	7	7	03	31.08	+22	37	59.69	1.016 7414	15	43.84	12	04	54.61
	8	7	07	37.36	22	31	34.50	1.016 7263	15	43.86	12	05	04.13
	9	7	11	43.23	22	24	45.91	1.016 7060	15	43.88	12	05	13.24
	10	7	15	48.68	22	17	34.09	1.016 6808	15	43.90	12	05	21.91
	11	7	19	53.68	22	09	59.21	1.016 6509	15	43.93	12	05	30.13
	12	7	23	58.22	22	02	01.47	1.016 6168	15	43.96	12	05	37.89
	13	7	28	02.30	+21	53	41.07	1.016 5787	15	43.99	12	05	45.16
	14	7	32	05.89	21	44	58.20	1.016 5368	15	44.03	12	05	51.95
	15	7	36	08.99	21	35	53.08	1.016 4913	15	44.08	12	05	58.23
	16	7	40	11.59	21	26	25.92	1.016 4424	15	44.12	12	06	04.01
	17	7	44	13.67	21	16	36.93	1.016 3900	15	44.17	12	06	09.27
	18	7	48	15.23	21	06	26.32	1.016 3342	15	44.22	12	06	14.01
	19	7	52	16.26	+20	55	54.32	1.016 2749	15	44.28	12	06	18.21
	20	7	56	16.75	20	45	01.13	1.016 2122	15	44.33	12	06	21.87
	21	8	00	16.69	20	33	47.00	1.016 1458	15	44.40	12	06	24.98
	22	8	04	16.08	20	22	12.15	1.016 0756	15	44.46	12	06	27.54
	23	8	08	14.92	20	10	16.81	1.016 0016	15	44.53	12	06	29.55
	24	8	12	13.19	19	58	01.22	1.015 9234	15	44.60	12	06	30.99
	25	8	16	10.90	+19	45	25.63	1.015 8409	15	44.68	12	06	31.86
	26	8	20	08.04	19	32	30.30	1.015 7540	15	44.76	12	06	32.15
	27	8	24	04.61	19	19	15.47	1.015 6622	15	44.85	12	06	31.87
	28	8	28	00.60	19	05	41.43	1.015 5654	15	44.94	12	06	31.01
	29	8	31	56.00	18	51	48.44	1.015 4633	15	45.03	12	06	29.55
	30	8	35	50.82	18	37	36.79	1.015 3557	15	45.13	12	06	27.51
	31	8	39	45.04	+18	23	06.78	1.015 2424	15	45.24	12	06	24.86
Aug.	1	8	43	38.66	18	08	18.70	1.015 1231	15	45.35	12	06	21.61
	2	8	47	31.67	17	53	12.84	1.014 9979	15	45.46	12	06	17.75
	3	8	51	24.05	17	37	49.51	1.014 8668	15	45.59	12	06	13.27
	4	8	55	15.82	17	22	08.99	1.014 7300	15	45.71	12	06	08.18
	5	8	59	06.97	17	06	11.59	1.014 5877	15	45.85	12	06	02.46
	6	9	02	57.49	+16	49	57.62	1.014 4403	15	45.98	12	05	56.13
	7	9	06	47.40	16	33	27.36	1.014 2882	15	46.13	12	05	49.18
	8	9	10	36.70	16	16	41.15	1.014 1317	15	46.27	12	05	41.61
	9	9	14	25.39	15	59	39.29	1.013 9711	15	46.42	12	05	33.44
	10	9	18	13.48	15	42	22.11	1.013 8070	15	46.58	12	05	24.68
	11	9	22	00.98	15	24	49.90	1.013 6395	15	46.73	12	05	15.32
	12	9	25	47.89	+15	07	02.99	1.013 4688	15	46.89	12	05	05.39
	13	9	29	34.23	14	49	01.68	1.013 2953	15	47.05	12	04	54.88
	14	9	33	20.01	14	30	46.28	1.013 1190	15	47.22	12	04	43.83
	15	9	37	05.23	14	12	17.09	1.012 9402	15	47.39	12	04	32.22
	16	9	40	49.91	+13	53	34.40	1.012 7588	15	47.56	12	04	20.09

SUN, 2019

FOR 0^h TERRESTRIAL TIME

Date	Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberration	Prec. in Long. (J 2019.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
	°	'	"	"	°	'	"	"	"	"	"	"
Aug. 16	142	52	25.86	-0.79	142	51	50.33	20.24	+6.13	-15.34	-2.20	10.01
17	143	50	04.02	0.86	143	49	28.42	20.24	6.27	15.41	2.15	10.07
18	144	47	43.48	0.94	144	47	07.76	20.24	6.41	15.52	2.10	10.12
19	145	45	24.39	0.97	145	44	48.55	20.25	6.54	15.63	2.06	10.15
20	146	43	06.78	0.97	146	42	30.82	20.25	6.68	15.76	2.04	10.17
21	147	40	50.71	0.97	147	40	14.63	20.26	6.82	15.87	2.04	10.17
22	148	38	36.26	-0.94	148	38	00.10	20.26	+6.96	-15.95	-2.05	10.16
23	149	36	23.44	0.86	149	35	47.22	20.26	7.10	16.00	2.06	10.15
24	150	34	12.34	0.76	150	33	36.11	20.27	7.24	16.01	2.08	10.13
25	151	32	02.99	0.65	151	31	26.80	20.27	7.38	15.97	2.09	10.12
26	152	29	55.37	0.54	152	29	19.25	20.28	7.52	15.89	2.08	10.13
27	153	27	49.54	0.40	153	27	13.50	20.28	7.66	15.80	2.05	10.15
28	154	25	45.44	-0.25	154	25	09.48	20.29	+7.79	-15.72	-2.00	10.20
29	155	23	43.08	0.11	155	23	07.15	20.29	7.93	15.69	1.93	10.27
30	156	21	42.40	-0.00	156	21	06.44	20.29	8.07	15.71	1.85	10.35
31	157	19	43.37	+0.07	157	19	07.32	20.30	8.21	15.80	1.78	10.42
Sept. 1	158	17	45.86	0.14	158	17	09.67	20.30	8.35	15.93	1.73	10.46
2	159	15	49.87	0.18	159	15	13.54	20.31	8.49	16.07	1.71	10.48
3	160	13	55.34	+0.14	160	13	18.88	20.31	+8.63	-16.19	-1.72	10.47
4	161	12	02.20	0.11	161	11	25.66	20.32	8.77	16.27	1.74	10.45
5	162	10	10.49	+0.04	162	09	33.91	20.32	8.91	16.30	1.77	10.42
6	163	08	20.18	-0.04	163	07	43.61	20.33	9.04	16.29	1.79	10.40
7	164	06	31.32	0.14	164	05	54.78	20.33	9.18	16.25	1.79	10.39
8	165	04	43.89	0.25	165	04	07.39	20.34	9.32	16.20	1.78	10.40
9	166	02	57.98	-0.40	166	02	21.52	20.34	+9.46	-16.17	-1.76	10.43
10	167	01	13.61	0.50	167	00	37.15	20.35	9.60	16.15	1.72	10.47
11	167	59	30.86	0.61	167	58	54.37	20.35	9.74	16.17	1.67	10.52
12	168	57	49.76	0.72	168	57	13.21	20.36	9.88	16.23	1.62	10.57
13	169	56	10.35	0.83	169	55	33.71	20.37	10.02	16.33	1.57	10.61
14	170	54	32.78	0.86	170	53	56.00	20.37	10.16	16.45	1.53	10.65
15	171	52	57.02	-0.90	171	52	20.10	20.38	+10.29	-16.59	-1.50	10.68
16	172	51	23.15	0.94	172	50	46.07	20.38	10.43	16.74	1.49	10.69
17	173	49	51.28	0.90	173	49	14.05	20.39	10.57	16.88	1.50	10.68
18	174	48	21.43	0.86	174	47	44.09	20.39	10.71	17.00	1.51	10.66
19	175	46	53.68	0.83	175	46	16.25	20.40	10.85	17.08	1.54	10.63
20	176	45	28.04	0.72	176	44	50.57	20.40	10.99	17.12	1.57	10.60
21	177	44	04.60	-0.61	177	43	27.12	20.41	+11.13	-17.11	-1.60	10.57
22	178	42	43.38	0.50	178	42	05.94	20.41	11.27	17.07	1.61	10.56
23	179	41	24.42	0.36	179	40	47.03	20.42	11.41	17.01	1.60	10.56
24	180	40	07.68	0.22	180	39	30.35	20.43	11.55	16.95	1.58	10.59
25	181	38	53.24	-0.11	181	38	15.94	20.43	11.68	16.92	1.53	10.64
26	182	37	41.04	+0.04	182	37	03.72	20.44	11.82	16.93	1.47	10.69
27	183	36	31.07	+0.11	183	35	53.66	20.44	+11.96	-17.01	-1.41	10.75
28	184	35	23.24	0.18	184	34	45.70	20.45	12.10	17.14	1.37	10.79
29	185	34	17.44	0.22	185	33	39.74	20.45	12.24	17.29	1.35	10.81
30	186	33	13.66	0.22	186	32	35.81	20.46	12.38	17.43	1.37	10.79
Oct. 1	187	32	11.81	+0.18	187	31	33.85	20.47	+12.52	-17.54	-1.40	10.75

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -16' 20".665 and subtract precession from J 2019.5.

SUN, 2019
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension h	m	s	Apparent Declination °	'	"	True Distance from the Earth	Semi Diameter '	"	Ephemeris Transit h	m	s
Aug.	16	9	40	49.91	+13	53	34.40	1.012 7588	15	47.56	12	04	20.09
	17	9	44	34.07	13	34	38.51	1.012 5749	15	47.73	12	04	07.44
	18	9	48	17.71	13	15	29.73	1.012 3885	15	47.90	12	03	54.28
	19	9	52	00.86	12	56	08.34	1.012 1996	15	48.08	12	03	40.63
	20	9	55	43.52	12	36	34.64	1.012 0081	15	48.26	12	03	26.51
	21	9	59	25.71	12	16	48.93	1.011 8140	15	48.44	12	03	11.92
	22	10	03	07.45	+11	56	51.52	1.011 6170	15	48.62	12	02	56.89
	23	10	06	48.75	11	36	42.69	1.011 4170	15	48.81	12	02	41.43
	24	10	10	29.62	11	16	22.76	1.011 2138	15	49.00	12	02	25.54
	25	10	14	10.09	10	55	52.04	1.011 0073	15	49.20	12	02	09.26
	26	10	17	50.16	10	35	10.85	1.010 7971	15	49.39	12	01	52.58
	27	10	21	29.85	10	14	19.52	1.010 5831	15	49.60	12	01	35.52
	28	10	25	09.17	+9	53	18.37	1.010 3649	15	49.80	12	01	18.10
	29	10	28	48.13	9	32	07.74	1.010 1423	15	50.01	12	01	00.33
	30	10	32	26.73	9	10	47.98	1.009 9153	15	50.22	12	00	42.21
	31	10	36	04.99	8	49	19.41	1.009 6837	15	50.44	12	00	23.76
Sept.	1	10	39	42.92	8	27	42.38	1.009 4477	15	50.66	12	00	04.98
	2	10	43	20.53	8	05	57.23	1.009 2073	15	50.89	11	59	45.90
	3	10	46	57.84	+7	44	04.29	1.008 9630	15	51.12	11	59	26.52
	4	10	50	34.86	7	22	03.90	1.008 7150	15	51.35	11	59	06.86
	5	10	54	11.61	6	59	56.40	1.008 4637	15	51.59	11	58	46.93
	6	10	57	48.11	6	37	42.14	1.008 2096	15	51.83	11	58	26.76
	7	11	01	24.38	6	15	21.46	1.007 9530	15	52.07	11	58	06.36
	8	11	05	00.42	5	52	54.69	1.007 6943	15	52.32	11	57	45.75
	9	11	08	36.27	+5	30	22.15	1.007 4338	15	52.56	11	57	24.95
	10	11	12	11.94	5	07	44.17	1.007 1717	15	52.81	11	57	03.99
	11	11	15	47.45	4	45	01.08	1.006 9084	15	53.06	11	56	42.88
	12	11	19	22.82	4	22	13.18	1.006 6440	15	53.31	11	56	21.65
	13	11	22	58.08	3	59	20.80	1.006 3787	15	53.56	11	56	00.32
	14	11	26	33.25	3	36	24.24	1.006 1126	15	53.81	11	55	38.90
	15	11	30	08.34	+3	13	23.81	1.005 8459	15	54.07	11	55	17.43
	16	11	33	43.40	2	50	19.82	1.005 5787	15	54.32	11	54	55.93
	17	11	37	18.43	2	27	12.58	1.005 3109	15	54.58	11	54	34.42
	18	11	40	53.46	2	04	02.39	1.005 0425	15	54.83	11	54	12.92
	19	11	44	28.52	1	40	49.56	1.004 7735	15	55.09	11	53	51.45
	20	11	48	03.63	1	17	34.41	1.004 5038	15	55.34	11	53	30.04
	21	11	51	38.81	+0	54	17.26	1.004 2333	15	55.60	11	53	08.72
	22	11	55	14.08	0	30	58.43	1.003 9618	15	55.86	11	52	47.49
	23	11	58	49.47	0	07	38.25	1.003 6891	15	56.12	11	52	26.38
	24	12	02	24.98	0	15	42.95	1.003 4150	15	56.38	11	52	05.42
	25	12	06	00.65	+0	39	04.81	1.003 1391	15	56.64	11	51	44.61
	26	12	09	36.48	-1	02	26.98	1.002 8614	15	56.91	11	51	23.99
	27	12	13	12.50	-1	25	49.09	1.002 5815	15	57.17	11	51	03.56
	28	12	16	48.72	1	49	10.80	1.002 2993	15	57.44	11	50	43.34
	29	12	20	25.16	2	12	31.72	1.002 0147	15	57.72	11	50	23.35
	30	12	24	01.83	2	35	51.50	1.001 7279	15	57.99	11	50	03.60
Oct.	1	12	27	38.76	-2	59	09.76	1.001 4389	15	58.27	11	49	44.11

SUN, 2019

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberration	Prec. in Long. (J 2019.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
Oct.	1	187	32	11.81	+0.18	187	31	33.85	20.47	+12.52	-17.54	-1.40	10.75
	2	188	31	11.82	0.14	188	30	33.80	20.47	12.66	17.59	1.45	10.71
	3	189	30	13.61	+0.04	189	29	35.59	20.48	12.80	17.59	1.49	10.66
	4	190	29	17.20	-0.07	190	28	39.22	20.48	12.93	17.55	1.52	10.63
	5	191	28	22.55	0.18	191	27	44.60	20.49	13.07	17.50	1.53	10.62
	6	192	27	29.62	0.29	192	26	51.72	20.50	13.21	17.45	1.53	10.62
	7	193	26	38.49	-0.43	193	26	00.60	20.50	+13.35	-17.43	-1.51	10.64
	8	194	25	49.14	0.54	194	25	11.24	20.51	13.49	17.44	1.48	10.67
	9	195	25	01.60	0.65	195	24	23.65	20.51	13.63	17.48	1.44	10.71
	10	196	24	15.90	0.72	196	23	37.86	20.52	13.77	17.56	1.41	10.74
	11	197	23	32.06	0.79	197	22	53.90	20.53	13.91	17.67	1.38	10.76
	12	198	22	50.15	0.83	198	22	11.86	20.53	14.05	17.81	1.37	10.77
	13	199	22	10.19	-0.83	199	21	31.75	20.54	+14.18	-17.95	-1.37	10.77
	14	200	21	32.21	0.83	200	20	53.63	20.54	14.32	18.08	1.39	10.75
	15	201	20	56.29	0.79	201	20	17.59	20.55	14.46	18.19	1.42	10.72
	16	202	20	22.46	0.72	202	19	43.68	20.56	14.60	18.27	1.47	10.67
	17	203	19	50.78	0.61	203	19	11.96	20.56	14.74	18.30	1.51	10.62
	18	204	19	21.30	0.50	204	18	42.48	20.57	14.88	18.30	1.56	10.58
	19	205	18	54.04	-0.40	205	18	15.26	20.57	+15.02	-18.25	-1.59	10.54
	20	206	18	29.06	0.25	206	17	50.35	20.58	15.16	18.18	1.61	10.53
	21	207	18	06.38	-0.11	207	17	27.74	20.58	15.30	18.10	1.60	10.53
	22	208	17	46.03	+0.00	208	17	07.44	20.59	15.43	18.04	1.58	10.55
	23	209	17	27.98	0.14	209	16	49.40	20.60	15.57	18.02	1.54	10.59
	24	210	17	12.21	0.22	210	16	33.60	20.60	15.71	18.06	1.50	10.63
	25	211	16	58.73	+0.29	211	16	20.03	20.61	+15.85	-18.15	-1.46	10.66
	26	212	16	47.48	0.32	212	16	08.65	20.61	15.99	18.27	1.45	10.68
	27	213	16	38.33	0.36	213	15	59.36	20.62	16.13	18.39	1.47	10.66
	28	214	16	31.23	0.32	214	15	52.16	20.62	16.27	18.49	1.51	10.62
	29	215	16	26.10	0.25	215	15	46.98	20.63	16.41	18.53	1.56	10.56
	30	216	16	22.85	0.18	216	15	43.74	20.63	16.55	18.52	1.62	10.50
	31	217	16	21.35	+0.07	217	15	42.30	20.64	+16.68	-18.46	-1.67	10.45
Nov.	1	218	16	21.60	-0.04	218	15	42.62	20.65	16.82	18.37	1.70	10.41
	2	219	16	23.53	0.18	219	15	44.64	20.65	16.96	18.28	1.72	10.40
	3	220	16	27.06	0.29	220	15	48.24	20.66	17.10	18.21	1.71	10.40
	4	221	16	32.17	0.40	221	15	53.39	20.66	17.24	18.17	1.69	10.42
	5	222	16	38.90	0.50	222	16	00.12	20.67	17.38	18.16	1.67	10.44
	6	223	16	47.18	-0.61	223	16	08.36	20.67	+17.52	-18.19	-1.64	10.47
	7	224	16	57.01	0.68	224	16	18.12	20.68	17.66	18.26	1.62	10.49
	8	225	17	08.45	0.72	225	16	29.46	20.68	17.80	18.35	1.61	10.49
	9	226	17	21.44	0.72	226	16	42.35	20.69	17.93	18.45	1.62	10.49
	10	227	17	36.02	0.72	227	16	56.82	20.69	18.07	18.55	1.64	10.46
	11	228	17	52.19	0.68	228	17	12.91	20.70	18.21	18.63	1.68	10.43
	12	229	18	10.03	-0.61	229	17	30.70	20.70	+18.35	-18.67	-1.73	10.38
	13	230	18	29.55	0.50	230	17	50.21	20.71	18.49	18.68	1.78	10.32
	14	231	18	50.79	0.40	231	18	11.48	20.71	18.63	18.64	1.83	10.27
	15	232	19	13.75	0.29	232	18	34.52	20.72	18.77	18.55	1.87	10.23
	16	233	19	38.48	-0.14	233	18	59.36	20.72	+18.91	-18.44	-1.90	10.20

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -16' 20".665 and subtract precession from J 2019.5.

SUN, 2019
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Oct.	1	12	27	38.76	-2	59	09.76	1.001 4389	15	58.27	11	49	44.11
	2	12	31	15.95	3	22	26.12	1.001 1482	15	58.54	11	49	24.90
	3	12	34	53.43	3	45	40.21	1.000 8559	15	58.82	11	49	05.97
	4	12	38	31.22	4	08	51.64	1.000 5626	15	59.11	11	48	47.36
	5	12	42	09.33	4	32	00.05	1.000 2685	15	59.39	11	48	29.08
	6	12	45	47.77	4	55	05.06	0.999 9741	15	59.67	11	48	11.15
	7	12	49	26.58	-5	18	06.30	0.999 6797	15	59.95	11	47	53.59
	8	12	53	05.77	5	41	03.40	0.999 3857	16	00.23	11	47	36.42
	9	12	56	45.36	6	03	56.00	0.999 0923	16	00.52	11	47	19.66
	10	13	00	25.37	6	26	43.74	0.998 7998	16	00.80	11	47	03.34
	11	13	04	05.82	6	49	26.27	0.998 5084	16	01.08	11	46	47.48
	12	13	07	46.74	7	12	03.23	0.998 2185	16	01.36	11	46	32.09
	13	13	11	28.15	-7	34	34.26	0.997 9302	16	01.64	11	46	17.20
	14	13	15	10.07	7	56	59.02	0.997 6436	16	01.91	11	46	02.84
	15	13	18	52.52	8	19	17.15	0.997 3589	16	02.19	11	45	49.01
	16	13	22	35.53	8	41	28.31	0.997 0761	16	02.46	11	45	35.75
	17	13	26	19.12	9	03	32.13	0.996 7952	16	02.73	11	45	23.08
	18	13	30	03.30	9	25	28.25	0.996 5163	16	03.00	11	45	11.01
	19	13	33	48.10	-9	47	16.32	0.996 2393	16	03.27	11	44	59.56
	20	13	37	33.54	10	08	55.97	0.995 9641	16	03.53	11	44	48.75
	21	13	41	19.63	10	30	26.81	0.995 6904	16	03.80	11	44	38.61
	22	13	45	06.39	10	51	48.47	0.995 4181	16	04.06	11	44	29.14
	23	13	48	53.83	11	13	00.54	0.995 1469	16	04.32	11	44	20.37
	24	13	52	41.97	11	34	02.62	0.994 8767	16	04.59	11	44	12.30
	25	13	56	30.82	-11	54	54.32	0.994 6070	16	04.85	11	44	04.96
	26	14	00	20.39	12	15	35.21	0.994 3378	16	05.11	11	43	58.34
	27	14	04	10.70	12	36	04.89	0.994 0688	16	05.37	11	43	52.46
	28	14	08	01.75	12	56	22.93	0.993 8001	16	05.63	11	43	47.33
	29	14	11	53.55	13	16	28.93	0.993 5315	16	05.89	11	43	42.95
	30	14	15	46.12	13	36	22.44	0.993 2634	16	06.15	11	43	39.33
	31	14	19	39.45	-13	56	03.05	0.992 9958	16	06.41	11	43	36.48
Nov.	1	14	23	33.56	14	15	30.33	0.992 7291	16	06.67	11	43	34.41
	2	14	27	28.44	14	34	43.84	0.992 4637	16	06.93	11	43	33.12
	3	14	31	24.12	14	53	43.16	0.992 1998	16	07.19	11	43	32.62
	4	14	35	20.58	15	12	27.88	0.991 9379	16	07.44	11	43	32.91
	5	14	39	17.84	15	30	57.57	0.991 6782	16	07.70	11	43	34.01
	6	14	43	15.91	-15	49	11.84	0.991 4211	16	07.95	11	43	35.92
	7	14	47	14.79	16	07	10.27	0.991 1669	16	08.20	11	43	38.65
	8	14	51	14.49	16	24	52.47	0.990 9158	16	08.44	11	43	42.21
	9	14	55	15.02	16	42	18.04	0.990 6683	16	08.68	11	43	46.59
	10	14	59	16.38	16	59	26.60	0.990 4244	16	08.92	11	43	51.82
	11	15	03	18.58	17	16	17.77	0.990 1844	16	09.16	11	43	57.88
	12	15	07	21.63	-17	32	51.15	0.989 9485	16	09.39	11	44	04.80
	13	15	11	25.53	17	49	06.39	0.989 7169	16	09.62	11	44	12.56
	14	15	15	30.29	18	05	03.10	0.989 4896	16	09.84	11	44	21.17
	15	15	19	35.90	18	20	40.92	0.989 2668	16	10.06	11	44	30.64
	16	15	23	42.37	-18	35	59.49	0.989 0484	16	10.27	11	44	40.97

SUN, 2019

FOR 0^h TERRESTRIAL TIME

Date		Geometric Longitude* (Mean Equinox of date)			Latitude (Ecliptic of date)	Apparent Longitude (True equinox of date)			Aberration	Prec. in Long. (J 2019.5 of date)	Nut. in Long.	Nut. in Obliquity	True Obliquity (23° 26')
		°	'	"	"	°	'	"	"	"	"	"	"
Nov.	16	233	19	38.48	-0.14	233	18	59.36	20.72	+18.91	-18.44	-1.90	10.20
	17	234	20	05.04	+0.00	234	19	26.04	20.73	19.05	18.32	1.90	10.20
	18	235	20	33.45	0.14	235	19	54.55	20.73	19.19	18.21	1.88	10.22
	19	236	21	03.69	0.25	236	20	24.86	20.74	19.32	18.14	1.85	10.25
	20	237	21	35.79	0.36	237	20	56.98	20.74	19.46	18.12	1.81	10.29
	21	238	22	09.74	0.43	238	21	30.89	20.74	19.60	18.15	1.77	10.32
	22	239	22	45.52	+0.50	239	22	06.60	20.75	+19.74	-18.22	-1.75	10.34
	23	240	23	23.01	0.50	240	22	44.00	20.75	19.88	18.30	1.76	10.33
	24	241	24	02.25	0.47	241	23	23.17	20.76	20.02	18.37	1.79	10.30
	25	242	24	43.07	0.43	242	24	03.96	20.76	20.16	18.40	1.84	10.25
	26	243	25	25.38	0.36	243	24	46.30	20.76	20.30	18.37	1.90	10.19
	27	244	26	09.11	0.25	244	25	30.11	20.77	20.44	18.28	1.95	10.14
	28	245	26	54.17	+0.14	245	26	15.29	20.77	+20.57	-18.16	-1.99	10.10
	29	246	27	40.44	-0.00	246	27	01.69	20.78	20.71	18.02	2.00	10.08
	30	247	28	27.83	0.14	247	27	49.21	20.78	20.85	17.89	2.00	10.08
Dec.	1	248	29	16.26	0.25	248	28	37.74	20.78	20.99	17.79	1.98	10.10
	2	249	30	05.70	0.36	249	29	27.24	20.79	21.13	17.72	1.95	10.13
	3	250	30	56.08	0.47	250	30	17.64	20.79	21.27	17.70	1.91	10.17
	4	251	31	47.36	-0.54	251	31	08.90	20.79	+21.41	-17.71	-1.88	10.19
	5	252	32	39.50	0.58	252	32	01.00	20.80	21.55	17.75	1.86	10.21
	6	253	33	32.45	0.61	253	32	53.88	20.80	21.69	17.81	1.85	10.22
	7	254	34	26.23	0.61	254	33	47.59	20.80	21.82	17.88	1.86	10.21
	8	255	35	20.78	0.58	255	34	42.10	20.81	21.96	17.93	1.88	10.19
	9	256	36	16.14	0.50	256	35	37.43	20.81	22.10	17.95	1.91	10.16
	10	257	37	12.29	-0.43	257	36	33.59	20.81	+22.24	-17.93	-1.95	10.11
	11	258	38	09.21	0.32	258	37	30.58	20.81	22.38	17.87	1.99	10.07
	12	259	39	06.99	0.18	259	38	28.46	20.82	22.52	17.76	2.03	10.04
	13	260	40	05.60	-0.04	260	39	27.22	20.82	22.66	17.61	2.05	10.02
	14	261	41	05.06	+0.11	261	40	26.83	20.82	22.80	17.45	2.04	10.02
	15	262	42	05.43	0.25	262	41	27.35	20.82	22.94	17.30	2.01	10.05
	16	263	43	06.77	+0.36	263	42	28.80	20.83	+23.08	-17.19	-1.97	10.09
	17	264	44	09.03	0.47	264	43	31.12	20.83	23.21	17.13	1.91	10.14
	18	265	45	12.27	0.58	265	44	34.37	20.83	23.35	17.12	1.86	10.20
	19	266	46	16.46	0.61	266	45	38.52	20.83	23.49	17.16	1.82	10.23
	20	267	47	21.57	0.65	267	46	43.57	20.83	23.63	17.21	1.81	10.25
	21	268	48	27.58	0.65	268	47	49.52	20.83	23.77	17.27	1.81	10.24
	22	269	49	34.41	+0.61	269	48	56.34	20.83	+23.91	-17.29	-1.84	10.21
	23	270	50	42.03	0.54	270	50	03.98	20.84	24.05	17.26	1.88	10.17
	24	271	51	50.28	0.43	271	51	12.31	20.84	24.19	17.17	1.91	10.13
	25	272	52	59.09	0.29	272	52	21.25	20.84	24.33	17.05	1.94	10.11
	26	273	54	08.39	0.18	273	53	30.70	20.84	24.46	16.90	1.95	10.10
	27	274	55	18.04	+0.04	274	54	40.50	20.84	24.60	16.75	1.93	10.11
	28	275	56	27.97	-0.11	275	55	50.56	20.84	+24.74	-16.62	-1.90	10.15
	29	276	57	38.08	0.22	276	57	00.76	20.84	24.88	16.53	1.85	10.19
	30	277	58	48.26	0.32	277	58	10.99	20.84	25.02	16.48	1.80	10.24
	31	278	59	58.46	0.40	278	59	21.19	20.84	25.16	16.47	1.75	10.29
	32	280	01	08.58	-0.47	280	00	31.28	20.84	+25.30	-16.49	-1.70	10.34

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -16' 20".665 and subtract precession from J 2019.5.

SUN, 2019
FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Semi Diameter		Ephemeris Transit		
		h	m	s	°	'	"		'	"	h	m	s
Nov.	16	15	23	42.37	-18	35	59.49	0.989 0484	16	10.27	11	44	40.97
	17	15	27	49.69	18	50	58.42	0.988 8342	16	10.48	11	44	52.15
	18	15	31	57.87	19	05	37.35	0.988 6243	16	10.69	11	45	04.19
	19	15	36	06.90	19	19	55.90	0.988 4184	16	10.89	11	45	17.07
	20	15	40	16.77	19	33	53.69	0.988 2162	16	11.09	11	45	30.80
	21	15	44	27.48	19	47	30.35	0.988 0175	16	11.28	11	45	45.36
	22	15	48	39.01	-20	00	45.50	0.987 8221	16	11.48	11	46	00.75
	23	15	52	51.36	20	13	38.78	0.987 6296	16	11.66	11	46	16.95
	24	15	57	04.52	20	26	09.81	0.987 4398	16	11.85	11	46	33.95
	25	16	01	18.48	20	38	18.25	0.987 2525	16	12.04	11	46	51.74
	26	16	05	33.20	20	50	03.75	0.987 0677	16	12.22	11	47	10.28
	27	16	09	48.68	21	01	25.95	0.986 8852	16	12.40	11	47	29.57
	28	16	14	04.90	-21	12	24.52	0.986 7053	16	12.57	11	47	49.58
	29	16	18	21.83	21	22	59.12	0.986 5281	16	12.75	11	48	10.29
	30	16	22	39.44	21	33	09.41	0.986 3537	16	12.92	11	48	31.67
Dec.	1	16	26	57.72	21	42	55.09	0.986 1825	16	13.09	11	48	53.71
	2	16	31	16.63	21	52	15.84	0.986 0146	16	13.26	11	49	16.38
	3	16	35	36.16	22	01	11.37	0.985 8505	16	13.42	11	49	39.66
	4	16	39	56.29	-22	09	41.40	0.985 6904	16	13.58	11	50	03.53
	5	16	44	16.99	22	17	45.67	0.985 5345	16	13.73	11	50	27.95
	6	16	48	38.23	22	25	23.93	0.985 3832	16	13.88	11	50	52.91
	7	16	53	00.00	22	32	35.94	0.985 2367	16	14.02	11	51	18.39
	8	16	57	22.27	22	39	21.48	0.985 0953	16	14.16	11	51	44.35
	9	17	01	45.02	22	45	40.35	0.984 9592	16	14.30	11	52	10.77
	10	17	06	08.21	-22	51	32.36	0.984 8288	16	14.43	11	52	37.63
	11	17	10	31.83	22	56	57.33	0.984 7041	16	14.55	11	53	04.90
	12	17	14	55.85	23	01	55.10	0.984 5853	16	14.67	11	53	32.56
	13	17	19	20.25	23	06	25.53	0.984 4727	16	14.78	11	54	00.57
	14	17	23	44.99	23	10	28.48	0.984 3662	16	14.89	11	54	28.91
	15	17	28	10.04	23	14	03.81	0.984 2658	16	14.99	11	54	57.56
	16	17	32	35.38	-23	17	11.42	0.984 1713	16	15.08	11	55	26.48
	17	17	37	00.98	23	19	51.18	0.984 0827	16	15.17	11	55	55.65
	18	17	41	26.81	23	22	02.99	0.983 9997	16	15.25	11	56	25.04
	19	17	45	52.84	23	23	46.76	0.983 9220	16	15.33	11	56	54.61
	20	17	50	19.03	23	25	02.42	0.983 8493	16	15.40	11	57	24.33
	21	17	54	45.35	23	25	49.89	0.983 7812	16	15.47	11	57	54.16
	22	17	59	11.78	-23	26	09.15	0.983 7175	16	15.53	11	58	24.08
	23	18	03	38.27	23	26	00.17	0.983 6579	16	15.59	11	58	54.04
	24	18	08	04.78	23	25	22.94	0.983 6022	16	15.64	11	59	24.00
	25	18	12	31.29	23	24	17.47	0.983 5502	16	15.69	11	59	53.93
	26	18	16	57.74	23	22	43.78	0.983 5019	16	15.74	12	00	23.78
	27	18	21	24.09	23	20	41.91	0.983 4573	16	15.79	12	00	53.52
	28	18	25	50.31	-23	18	11.90	0.983 4164	16	15.83	12	01	23.11
	29	18	30	16.36	23	15	13.82	0.983 3794	16	15.86	12	01	52.51
	30	18	34	42.20	23	11	47.74	0.983 3463	16	15.90	12	02	21.69
	31	18	39	07.80	23	07	53.76	0.983 3175	16	15.93	12	02	50.60
	32	18	43	33.11	-23	03	31.98	0.983 2931	16	15.95	12	03	19.22

SUN, 2019

EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2019.5 AND J 2000.0

Date		$X_{2019.5}$	$X_{2000.0}$	$Y_{2019.5}$	$Y_{2000.0}$	$Z_{2019.5}$	$Z_{2000.0}$
Jan.	0	+0.154 2345	+0.153 5026	-0.891 1407	-0.891 1391	-0.386 0101	-0.386 3054
	1	0.171 4854	0.170 7557	0.888 4836	0.888 4820	0.384 8258	0.385 1537
	2	0.188 6841	0.187 9569	0.885 5489	0.885 5474	0.383 5213	0.383 8818
	3	0.205 8251	0.205 1005	0.882 3374	0.882 3359	0.382 0971	0.382 4900
	4	0.222 9025	0.222 1808	0.878 8499	0.878 8484	0.380 5534	0.380 9787
	5	0.239 9109	0.239 1923	0.875 0874	0.875 0859	0.378 8909	0.379 3484
	6	+0.256 8445	+0.256 1293	-0.871 0512	-0.871 0497	-0.377 1098	-0.377 5994
	7	0.273 6978	0.272 9861	0.866 7425	0.866 7410	0.375 2108	0.375 7323
	8	0.290 4652	0.289 7574	0.862 1628	0.862 1614	0.373 1945	0.373 7478
	9	0.307 1414	0.306 4375	0.857 3138	0.857 3124	0.371 0616	0.371 6464
	10	0.323 7208	0.323 0212	0.852 1972	0.852 1957	0.368 8128	0.369 4290
	11	0.340 1982	0.339 5031	0.846 8148	0.846 8133	0.366 4489	0.367 0963
	12	+0.356 5684	+0.355 8779	-0.841 1686	-0.841 1671	-0.363 9707	-0.364 6492
	13	0.372 8261	0.372 1405	0.835 2606	0.835 2592	0.361 3792	0.362 0884
	14	0.388 9663	0.388 2858	0.829 0931	0.829 0917	0.358 6752	0.359 4150
	15	0.404 9841	0.404 3089	0.822 6682	0.822 6669	0.355 8597	0.356 6298
	16	0.420 8745	0.420 2049	0.815 9884	0.815 9871	0.352 9338	0.353 7340
	17	0.436 6330	0.435 9690	0.809 0561	0.809 0547	0.349 8985	0.350 7285
	18	+0.452 2549	+0.451 5968	-0.801 8736	-0.801 8723	-0.346 7548	-0.347 6144
	19	0.467 7357	0.467 0837	0.794 4435	0.794 4422	0.343 5040	0.344 3929
	20	0.483 0710	0.482 4254	0.786 7682	0.786 7669	0.340 1471	0.341 0650
	21	0.498 2567	0.497 6176	0.778 8502	0.778 8489	0.336 6852	0.337 6319
	22	0.513 2885	0.512 6562	0.770 6919	0.770 6906	0.333 1194	0.334 0945
	23	0.528 1622	0.527 5368	0.762 2955	0.762 2942	0.329 4508	0.330 4541
	24	+0.542 8735	+0.542 2552	-0.753 6633	-0.753 6621	-0.325 6803	-0.326 7115
	25	0.557 4181	0.556 8072	0.744 7978	0.744 7966	0.321 8092	0.322 8678
	26	0.571 7917	0.571 1882	0.735 7012	0.735 7001	0.317 8384	0.318 9242
	27	0.585 9896	0.585 3938	0.726 3761	0.726 3750	0.313 7690	0.314 8817
	28	0.600 0074	0.599 4195	0.716 8251	0.716 8240	0.309 6022	0.310 7414
	29	0.613 8405	0.613 2607	0.707 0510	0.707 0499	0.305 3392	0.306 5046
	30	+0.627 4845	+0.626 9130	-0.697 0566	-0.697 0555	-0.300 9812	-0.302 1724
	31	0.640 9349	0.640 3718	0.686 8450	0.686 8440	0.296 5295	0.297 7463
Feb.	1	0.654 1873	0.653 6327	0.676 4195	0.676 4184	0.291 9856	0.293 2274
	2	0.667 2373	0.666 6914	0.665 7832	0.665 7822	0.287 3508	0.288 6173
	3	0.680 0806	0.679 5437	0.654 9397	0.654 9387	0.282 6266	0.283 9174
	4	0.692 7132	0.692 1854	0.643 8925	0.643 8915	0.277 8144	0.279 1291
	5	+0.705 1308	+0.704 6123	-0.632 6452	-0.632 6443	-0.272 9160	-0.274 2542
	6	0.717 3297	0.716 8205	0.621 2017	0.621 2008	0.267 9328	0.269 2941
	7	0.729 3058	0.728 8063	0.609 5658	0.609 5649	0.262 8666	0.264 2505
	8	0.741 0555	0.740 5657	0.597 7414	0.597 7405	0.257 7190	0.259 1251
	9	0.752 5753	0.752 0954	0.585 7325	0.585 7317	0.252 4917	0.253 9196
	10	0.763 8616	0.763 3917	0.573 5433	0.573 5425	0.247 1865	0.248 6358
	11	+0.774 9111	+0.774 4514	-0.561 1778	-0.561 1770	-0.241 8053	-0.243 2754
	12	0.785 7207	0.785 2713	0.548 6403	0.548 6395	0.236 3497	0.237 8403
	13	0.796 2873	0.795 8484	0.535 9350	0.535 9343	0.230 8218	0.232 3324
	14	0.806 6080	0.806 1797	0.523 0662	0.523 0655	0.225 2232	0.226 7533
	15	+0.816 6802	+0.816 2626	-0.510 0380	-0.510 0373	-0.219 5560	-0.221 1051

SUN, 2019

EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2019.5 AND J 2000.0

Date		$X_{2019.5}$	$X_{2000.0}$	$Y_{2019.5}$	$Y_{2000.0}$	$Z_{2019.5}$	$Z_{2000.0}$
Feb.	15	+0.816 6802	+0.816 2626	-0.510 0380	-0.510 0373	-0.219 5560	-0.221 1051
	16	0.826 5012	0.826 0945	0.496 8548	0.496 8542	0.213 8219	0.215 3896
	17	0.836 0686	0.835 6729	0.483 5208	0.483 5201	0.208 0228	0.209 6086
	18	0.845 3802	0.844 9955	0.470 0399	0.470 0393	0.202 1605	0.203 7639
	19	0.854 4335	0.854 0600	0.456 4163	0.456 4157	0.196 2369	0.197 8574
	20	0.863 2265	0.862 8643	0.442 6539	0.442 6534	0.190 2537	0.191 8908
	21	+0.871 7568	+0.871 4061	-0.428 7567	-0.428 7561	-0.184 2127	-0.185 8659
	22	0.880 0221	0.879 6830	0.414 7284	0.414 7279	0.178 1155	0.179 7843
	23	0.888 0201	0.887 6926	0.400 5730	0.400 5725	0.171 9638	0.173 6478
	24	0.895 7484	0.895 4326	0.386 2946	0.386 2941	0.165 7596	0.167 4581
	25	0.903 2044	0.902 9005	0.371 8972	0.371 8968	0.159 5044	0.161 2170
	26	0.910 3859	0.910 0939	0.357 3851	0.357 3847	0.153 2002	0.154 9264
	27	+0.917 2905	+0.917 0105	-0.342 7627	-0.342 7623	-0.146 8488	-0.148 5880
	28	0.923 9159	0.923 6481	0.328 0343	0.328 0340	0.140 4522	0.142 2039
Mar.	1	0.930 2601	0.930 0044	0.313 2046	0.313 2043	0.134 0122	0.135 7758
	2	0.936 3209	0.936 0775	0.298 2782	0.298 2779	0.127 5308	0.129 3059
	3	0.942 0964	0.941 8654	0.283 2598	0.283 2595	0.121 0102	0.122 7962
	4	0.947 5849	0.947 3663	0.268 1542	0.268 1539	0.114 4522	0.116 2486
	5	+0.952 7846	+0.952 5784	-0.252 9661	-0.252 9659	-0.107 8591	-0.109 6652
	6	0.957 6940	0.957 5004	0.237 7006	0.237 7005	0.101 2328	0.103 0482
	7	0.962 3116	0.962 1307	0.222 3626	0.222 3624	0.094 5755	0.096 3996
	8	0.966 6363	0.966 4680	0.206 9569	0.206 9568	0.087 8894	0.089 7216
	9	0.970 6668	0.970 5112	0.191 4887	0.191 4887	0.081 1766	0.083 0164
	10	0.974 4023	0.974 2594	0.175 9630	0.175 9629	0.074 4392	0.076 2861
	11	+0.977 8418	+0.977 7118	-0.160 3848	-0.160 3847	-0.067 6795	-0.069 5328
	12	0.980 9848	0.980 8676	0.144 7590	0.144 7590	0.060 8996	0.062 7588
	13	0.983 8308	0.983 7265	0.129 0908	0.129 0908	0.054 1017	0.055 9663
	14	0.986 3794	0.986 2880	0.113 3851	0.113 3851	0.047 2880	0.049 1574
	15	0.988 6304	0.988 5520	0.097 6467	0.097 6468	0.040 4606	0.042 3342
	16	0.990 5838	0.990 5183	0.081 8806	0.081 8807	0.033 6217	0.035 4989
	17	+0.992 2397	+0.992 1872	-0.066 0914	-0.066 0915	-0.026 7733	-0.028 6536
	18	0.993 5983	0.993 5588	0.050 2838	0.050 2839	0.019 9175	0.021 8003
	19	0.994 6597	0.994 6332	0.034 4622	0.034 4624	0.013 0563	0.014 9411
	20	0.995 4243	0.995 4108	0.018 6313	0.018 6315	-0.006 1917	0.008 0778
	21	0.995 8922	0.995 8917	-0.002 7951	-0.002 7954	+0.000 6745	-0.001 2125
	22	0.996 0636	0.996 0761	+0.013 0419	+0.013 0416	0.007 5404	+0.005 6531
	23	+0.995 9386	+0.995 9641	+0.028 8755	+0.028 8751	+0.014 4040	+0.012 5170
	24	0.995 5174	0.995 5559	0.044 7012	0.044 7009	0.021 2635	0.019 3773
	25	0.994 7999	0.994 8515	0.060 5148	0.060 5144	0.028 1169	0.026 2322
	26	0.993 7864	0.993 8509	0.076 3116	0.076 3112	0.034 9625	0.033 0797
	27	0.992 4771	0.992 5545	0.092 0871	0.092 0867	0.041 7981	0.039 9179
	28	0.990 8721	0.990 9625	0.107 8366	0.107 8362	0.048 6218	0.046 7447
	29	+0.988 9720	+0.989 0753	+0.123 5555	+0.123 5550	+0.055 4316	+0.053 5582
	30	0.986 7772	0.986 8934	0.139 2389	0.139 2384	0.062 2255	0.060 3563
	31	0.984 2883	0.984 4174	0.154 8822	0.154 8816	0.069 0014	0.067 1370
Apr.	1	0.981 5062	0.981 6480	0.170 4804	0.170 4799	0.075 7573	0.073 8982
	2	+0.978 4316	+0.978 5862	+0.186 0289	+0.186 0284	+0.082 4912	+0.080 6379

SUN, 2019

EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2019.5 AND J 2000.0

Date		$X_{2019.5}$	$X_{2000.0}$	$Y_{2019.5}$	$Y_{2000.0}$	$Z_{2019.5}$	$Z_{2000.0}$
Apr.	1	+0.981 5062	+0.981 6480	+0.170 4804	+0.170 4799	+0.075 7573	+0.073 8982
	2	0.978 4316	0.978 5862	0.186 0289	0.186 0284	0.082 4912	0.080 6379
	3	0.975 0657	0.975 2330	0.201 5228	0.201 5222	0.089 2009	0.087 3541
	4	0.971 4094	0.971 5894	0.216 9573	0.216 9567	0.095 8845	0.094 0446
	5	0.967 4642	0.967 6568	0.232 3276	0.232 3269	0.102 5397	0.100 7074
	6	0.963 2314	0.963 4366	0.247 6289	0.247 6282	0.109 1647	0.107 3405
	7	+0.958 7126	+0.958 9303	+0.262 8564	+0.262 8557	+0.115 7573	+0.113 9417
	8	0.953 9095	0.954 1396	0.278 0054	0.278 0047	0.122 3155	0.120 5090
	9	0.948 8240	0.949 0665	0.293 0713	0.293 0706	0.128 8373	0.127 0405
	10	0.943 4581	0.943 7129	0.308 0495	0.308 0487	0.135 3206	0.133 5340
	11	0.937 8140	0.938 0810	0.322 9355	0.322 9347	0.141 7635	0.139 9877
	12	0.931 8939	0.932 1730	0.337 7249	0.337 7240	0.148 1641	0.146 3995
	13	+0.925 7002	+0.925 9914	+0.352 4134	+0.352 4125	+0.154 5205	+0.152 7677
	14	0.919 2354	0.919 5386	0.366 9970	0.366 9961	0.160 8309	0.159 0904
	15	0.912 5019	0.912 8170	0.381 4717	0.381 4707	0.167 0935	0.165 3658
	16	0.905 5024	0.905 8292	0.395 8335	0.395 8326	0.173 3066	0.171 5922
	17	0.898 2392	0.898 5778	0.410 0788	0.410 0778	0.179 4685	0.177 7680
	18	0.890 7150	0.891 0651	0.424 2039	0.424 2029	0.185 5777	0.183 8915
	19	+0.882 9320	+0.883 2936	+0.438 2052	+0.438 2042	+0.191 6326	+0.189 9611
	20	0.874 8926	0.875 2656	0.452 0791	0.452 0781	0.197 6316	0.195 9754
	21	0.866 5991	0.866 9834	0.465 8220	0.465 8210	0.203 5732	0.201 9327
	22	0.858 0540	0.858 4494	0.479 4303	0.479 4292	0.209 4557	0.207 8315
	23	0.849 2593	0.849 6659	0.492 9003	0.492 8992	0.215 2778	0.213 6703
	24	0.840 2177	0.840 6351	0.506 2282	0.506 2270	0.221 0376	0.219 4473
	25	+0.830 9315	+0.831 3598	+0.519 4102	+0.519 4090	+0.226 7338	+0.225 1611
	26	0.821 4033	0.821 8423	0.532 4426	0.532 4414	0.232 3646	0.230 8100
	27	0.811 6358	0.812 0853	0.545 3215	0.545 3203	0.237 9284	0.236 3923
	28	0.801 6318	0.802 0917	0.558 0432	0.558 0420	0.243 4236	0.241 9066
	29	0.791 3940	0.791 8643	0.570 6039	0.570 6026	0.248 8487	0.247 3511
	30	0.780 9256	0.781 4060	0.582 9998	0.582 9985	0.254 2020	0.252 7243
May	1	+0.770 2295	+0.770 7199	+0.595 2272	+0.595 2259	+0.259 4820	+0.258 0246
	2	0.759 3090	0.759 8093	0.607 2824	0.607 2811	0.264 6870	0.263 2503
	3	0.748 1674	0.748 6775	0.619 1618	0.619 1605	0.269 8155	0.268 4000
	4	0.736 8082	0.737 3278	0.630 8618	0.630 8604	0.274 8660	0.273 4721
	5	0.725 2348	0.725 7639	0.642 3787	0.642 3774	0.279 8369	0.278 4649
	6	0.713 4510	0.713 9894	0.653 7093	0.653 7079	0.284 7267	0.283 3771
	7	+0.701 4606	+0.702 0081	+0.664 8500	+0.664 8486	+0.289 5340	+0.288 2071
	8	0.689 2676	0.689 8241	0.675 7977	0.675 7963	0.294 2573	0.292 9536
	9	0.676 8759	0.677 4412	0.686 5492	0.686 5478	0.298 8953	0.297 6151
	10	0.664 2898	0.664 8637	0.697 1015	0.697 1001	0.303 4466	0.302 1902
	11	0.651 5133	0.652 0957	0.707 4520	0.707 4506	0.307 9100	0.306 6779
	12	0.638 5506	0.639 1413	0.717 5979	0.717 5965	0.312 2843	0.311 0768
	13	+0.625 4059	+0.626 0048	+0.727 5367	+0.727 5353	+0.316 5684	+0.315 3859
	14	0.612 0833	0.612 6902	0.737 2661	0.737 2646	0.320 7613	0.319 6040
	15	0.598 5870	0.599 2016	0.746 7838	0.746 7823	0.324 8619	0.323 7303
	16	0.584 9209	0.585 5431	0.756 0876	0.756 0861	0.328 8693	0.327 7636
	17	+0.571 0889	+0.571 7186	+0.765 1754	+0.765 1739	+0.332 7826	+0.331 7031

SUN, 2019

EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2019.5 AND J 2000.0

Date		$X_{2019.5}$	$X_{2000.0}$	$Y_{2019.5}$	$Y_{2000.0}$	$Z_{2019.5}$	$Z_{2000.0}$
May	17	+0.571 0889	+0.571 7186	+0.765 1754	+0.765 1739	+0.332 7826	+0.331 7031
	18	0.557 0949	0.557 7319	0.774 0450	0.774 0435	0.336 6009	0.335 5479
	19	0.542 9428	0.543 5869	0.782 6944	0.782 6929	0.340 3232	0.339 2971
	20	0.528 6364	0.529 2874	0.791 1214	0.791 1199	0.343 9487	0.342 9497
	21	0.514 1794	0.514 8371	0.799 3239	0.799 3223	0.347 4765	0.346 5049
	22	0.499 5757	0.500 2399	0.807 2996	0.807 2980	0.350 9057	0.349 9618
	23	+0.484 8293	+0.485 4998	+0.815 0464	+0.815 0448	+0.354 2353	+0.353 3194
	24	0.469 9440	0.470 6206	0.822 5621	0.822 5605	0.357 4644	0.356 5768
	25	0.454 9239	0.455 6065	0.829 8444	0.829 8428	0.360 5923	0.359 7331
	26	0.439 7731	0.440 4615	0.836 8913	0.836 8897	0.363 6178	0.362 7874
	27	0.424 4959	0.425 1899	0.843 7006	0.843 6990	0.366 5403	0.365 7388
	28	0.409 0965	0.409 7959	0.850 2703	0.850 2687	0.369 3587	0.368 5864
	29	+0.393 5793	+0.394 2838	+0.856 5984	+0.856 5968	+0.372 0723	+0.371 3294
	30	0.377 9487	0.378 6582	0.862 6829	0.862 6812	0.374 6802	0.373 9670
	31	0.362 2092	0.362 9234	0.868 5218	0.868 5201	0.377 1817	0.376 4983
June	1	0.346 3654	0.347 0842	0.874 1133	0.874 1117	0.379 5758	0.378 9225
	2	0.330 4221	0.331 1453	0.879 4558	0.879 4541	0.381 8619	0.381 2388
	3	0.314 3841	0.315 1114	0.884 5475	0.884 5458	0.384 0393	0.383 4466
	4	+0.298 2562	+0.298 9875	+0.889 3868	+0.889 3852	+0.386 1073	+0.385 5451
	5	0.282 0436	0.282 7786	0.893 9725	0.893 9708	0.388 0651	0.387 5337
	6	0.265 7511	0.266 4896	0.898 3032	0.898 3016	0.389 9124	0.389 4119
	7	0.249 3839	0.250 1258	0.902 3780	0.902 3763	0.391 6486	0.391 1791
	8	0.232 9471	0.233 6921	0.906 1959	0.906 1943	0.393 2732	0.392 8349
	9	0.216 4456	0.217 1935	0.909 7563	0.909 7546	0.394 7860	0.394 3789
	10	+0.199 8845	+0.200 6351	+0.913 0585	+0.913 0569	+0.396 1866	+0.395 8110
	11	0.183 2686	0.184 0216	0.916 1022	0.916 1005	0.397 4749	0.397 1307
	12	0.166 6026	0.167 3579	0.918 8869	0.918 8852	0.398 6507	0.398 3381
	13	0.149 8912	0.150 6485	0.921 4122	0.921 4106	0.399 7138	0.399 4329
	14	0.133 1390	0.133 8981	0.923 6781	0.923 6764	0.400 6641	0.400 4150
	15	0.116 3504	0.117 1112	0.925 6841	0.925 6824	0.401 5016	0.401 2843
	16	+0.099 5300	+0.100 2922	+0.927 4299	+0.927 4282	+0.402 2262	+0.402 0407
	17	0.082 6820	0.083 4454	0.928 9154	0.928 9137	0.402 8376	0.402 6841
	18	0.065 8110	0.066 5754	0.930 1402	0.930 1385	0.403 3360	0.403 2144
	19	0.048 9214	0.049 6865	0.931 1040	0.931 1023	0.403 7212	0.403 6316
	20	0.032 0174	0.032 7831	0.931 8065	0.931 8048	0.403 9930	0.403 9355
	21	+0.015 1038	+0.015 8698	0.932 2474	0.932 2457	0.404 1515	0.404 1260
	22	-0.001 8152	-0.001 0491	+0.932 4265	+0.932 4248	+0.404 1965	+0.404 2031
	23	0.018 7348	0.017 9688	0.932 3434	0.932 3418	0.404 1280	0.404 1666
	24	0.035 6504	0.034 8847	0.931 9982	0.931 9965	0.403 9459	0.404 0166
	25	0.052 5575	0.051 7923	0.931 3906	0.931 3889	0.403 6503	0.403 7530
	26	0.069 4513	0.068 6868	0.930 5205	0.930 5188	0.403 2410	0.403 3757
	27	0.086 3269	0.085 5635	0.929 3880	0.929 3863	0.402 7182	0.402 8848
	28	-0.103 1797	-0.102 4174	+0.927 9931	+0.927 9914	+0.402 0818	+0.402 2804
	29	0.120 0047	0.119 2438	0.926 3359	0.926 3343	0.401 3319	0.401 5624
	30	0.136 7970	0.136 0377	0.924 4167	0.924 4151	0.400 4686	0.400 7309
July	1	0.153 5516	0.152 7941	0.922 2359	0.922 2342	0.399 4921	0.399 7862
	2	-0.170 2634	-0.169 5080	+0.919 7938	+0.919 7922	+0.398 4026	+0.398 7283

SUN, 2019

EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2019.5 AND J 2000.0

Date		$X_{2019.5}$	$X_{2000.0}$	$Y_{2019.5}$	$Y_{2000.0}$	$Z_{2019.5}$	$Z_{2000.0}$
July	1	-0.153 5516	-0.152 7941	+0.922 2359	+0.922 2342	+0.399 4921	+0.399 7862
	2	0.170 2634	0.169 5080	0.919 7938	0.919 7922	0.398 4026	0.398 7283
	3	0.186 9273	0.186 1741	0.917 0911	0.917 0895	0.397 2002	0.397 5574
	4	0.203 5381	0.202 7874	0.914 1286	0.914 1270	0.395 8853	0.396 2740
	5	0.220 0908	0.219 3428	0.910 9073	0.910 9057	0.394 4583	0.394 8783
	6	0.236 5803	0.235 8351	0.907 4283	0.907 4268	0.392 9196	0.393 3709
	7	-0.253 0016	-0.252 2596	+0.903 6931	+0.903 6915	+0.391 2698	+0.391 7523
	8	0.269 3500	0.268 6113	0.899 7029	0.899 7014	0.389 5096	0.390 0229
	9	0.285 6208	0.284 8856	0.895 4594	0.895 4579	0.387 6395	0.388 1836
	10	0.301 8094	0.301 0779	0.890 9641	0.890 9626	0.385 6602	0.386 2350
	11	0.317 9115	0.317 1839	0.886 2187	0.886 2172	0.383 5725	0.384 1778
	12	0.333 9227	0.333 1992	0.881 2247	0.881 2232	0.381 3770	0.382 0127
	13	-0.349 8388	-0.349 1197	+0.875 9838	+0.875 9823	+0.379 0745	+0.379 7403
	14	0.365 6557	0.364 9411	0.870 4975	0.870 4961	0.376 6658	0.377 3615
	15	0.381 3692	0.380 6594	0.864 7675	0.864 7661	0.374 1515	0.374 8770
	16	0.396 9753	0.396 2704	0.858 7953	0.858 7939	0.371 5324	0.372 2874
	17	0.412 4698	0.411 7701	0.852 5826	0.852 5812	0.368 8092	0.369 5935
	18	0.427 8488	0.427 1544	0.846 1308	0.846 1294	0.365 9826	0.366 7961
	19	-0.443 1081	-0.442 4192	+0.839 4416	+0.839 4402	+0.363 0534	+0.363 8958
	20	0.458 2436	0.457 5604	0.832 5167	0.832 5153	0.360 0222	0.360 8933
	21	0.473 2511	0.472 5739	0.825 3576	0.825 3562	0.356 8900	0.357 7894
	22	0.488 1267	0.487 4555	0.817 9661	0.817 9648	0.353 6573	0.354 5850
	23	0.502 8660	0.502 2011	0.810 3440	0.810 3426	0.350 3251	0.351 2807
	24	0.517 4648	0.516 8064	0.802 4930	0.802 4917	0.346 8941	0.347 8773
	25	-0.531 9191	-0.531 2674	+0.794 4150	+0.794 4137	+0.343 3651	+0.344 3757
	26	0.546 2246	0.545 5797	0.786 1120	0.786 1108	0.339 7390	0.340 7766
	27	0.560 3770	0.559 7391	0.777 5861	0.777 5848	0.336 0167	0.337 0811
	28	0.574 3720	0.573 7413	0.768 8392	0.768 8379	0.332 1991	0.333 2899
	29	0.588 2054	0.587 5821	0.759 8736	0.759 8724	0.328 2870	0.329 4041
	30	0.601 8727	0.601 2570	0.750 6917	0.750 6905	0.324 2816	0.325 4245
	31	-0.615 3696	-0.614 7617	+0.741 2959	+0.741 2948	+0.320 1838	+0.321 3522
Aug.	1	0.628 6919	0.628 0918	0.731 6890	0.731 6879	0.315 9947	0.317 1884
	2	0.641 8352	0.641 2432	0.721 8737	0.721 8726	0.311 7157	0.312 9342
	3	0.654 7954	0.654 2117	0.711 8532	0.711 8521	0.307 3479	0.308 5909
	4	0.667 5685	0.666 9932	0.701 6304	0.701 6293	0.302 8926	0.304 1599
	5	0.680 1508	0.679 5841	0.691 2088	0.691 2077	0.298 3514	0.299 6424
	6	-0.692 5385	-0.691 9805	+0.680 5916	+0.680 5905	+0.293 7255	+0.295 0400
	7	0.704 7282	0.704 1792	0.669 7821	0.669 7811	0.289 0165	0.290 3540
	8	0.716 7167	0.716 1767	0.658 7836	0.658 7826	0.284 2258	0.285 5860
	9	0.728 5007	0.727 9700	0.647 5995	0.647 5985	0.279 3548	0.280 7373
	10	0.740 0772	0.739 5558	0.636 2329	0.636 2319	0.274 4050	0.275 8094
	11	0.751 4431	0.750 9311	0.624 6870	0.624 6861	0.269 3778	0.270 8037
	12	-0.762 5953	-0.762 0931	+0.612 9652	+0.612 9643	+0.264 2747	+0.265 7217
	13	0.773 5311	0.773 0386	0.601 0705	0.601 0696	0.259 0971	0.260 5647
	14	0.784 2474	0.783 7649	0.589 0062	0.589 0053	0.253 8463	0.255 3342
	15	0.794 7414	0.794 2689	0.576 7754	0.576 7746	0.248 5238	0.250 0316
	16	-0.805 0102	-0.804 5479	+0.564 3813	+0.564 3805	+0.243 1311	+0.244 6583

SUN, 2019

EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2019.5 AND J 2000.0

Date		$X_{2019.5}$	$X_{2000.0}$	$Y_{2019.5}$	$Y_{2000.0}$	$Z_{2019.5}$	$Z_{2000.0}$
Aug.	16	-0.805 0102	-0.804 5479	+0.564 3813	+0.564 3805	+0.243 1311	+0.244 6583
	17	0.815 0509	0.814 5990	0.551 8271	0.551 8263	0.237 6694	0.239 2156
	18	0.824 8607	0.824 4192	0.539 1161	0.539 1154	0.232 1404	0.233 7051
	19	0.834 4367	0.834 0058	0.526 2515	0.526 2508	0.226 5453	0.228 1281
	20	0.843 7761	0.843 3560	0.513 2366	0.513 2359	0.220 8857	0.222 4862
	21	0.852 8761	0.852 4667	0.500 0748	0.500 0741	0.215 1630	0.216 7806
	22	-0.861 7337	-0.861 3353	+0.486 7694	+0.486 7687	+0.209 3786	+0.211 0130
	23	0.870 3463	0.869 9589	0.473 3239	0.473 3233	0.203 5341	0.205 1848
	24	0.878 7108	0.878 3347	0.459 7419	0.459 7413	0.197 6311	0.199 2976
	25	0.886 8246	0.886 4598	0.446 0269	0.446 0264	0.191 6710	0.193 3528
	26	0.894 6849	0.894 3314	0.432 1827	0.432 1822	0.185 6554	0.187 3520
	27	0.902 2887	0.901 9467	0.418 2131	0.418 2126	0.179 5859	0.181 2970
	28	-0.909 6333	-0.909 3029	+0.404 1219	+0.404 1214	+0.173 4643	+0.175 1892
	29	0.916 7161	0.916 3974	0.389 9134	0.389 9130	0.167 2923	0.169 0306
	30	0.923 5343	0.923 2274	0.375 5918	0.375 5913	0.161 0716	0.162 8228
	31	0.930 0857	0.929 7906	0.361 1614	0.361 1610	0.154 8042	0.156 5677
Sept.	1	0.936 3678	0.936 0846	0.346 6268	0.346 6264	0.148 4920	0.150 2673
	2	0.942 3786	0.942 1075	0.331 9926	0.331 9922	0.142 1369	0.143 9236
	3	-0.948 1164	-0.947 8574	+0.317 2633	+0.317 2629	+0.135 7409	+0.137 5384
	4	0.953 5795	0.953 3327	0.302 4435	0.302 4432	0.129 3061	0.131 1139
	5	0.958 7664	0.958 5318	0.287 5376	0.287 5374	0.122 8343	0.124 6519
	6	0.963 6757	0.963 4535	0.272 5502	0.272 5500	0.116 3275	0.118 1544
	7	0.968 3063	0.968 0965	0.257 4855	0.257 4853	0.109 7877	0.111 6233
	8	0.972 6570	0.972 4596	0.242 3480	0.242 3478	0.103 2168	0.105 0606
	9	-0.976 7265	-0.976 5416	+0.227 1417	+0.227 1416	+0.096 6166	+0.098 4680
	10	0.980 5139	0.980 3416	0.211 8711	0.211 8710	0.089 9891	0.091 8476
	11	0.984 0180	0.983 8583	0.196 5403	0.196 5402	0.083 3360	0.085 2011
	12	0.987 2380	0.987 0909	0.181 1535	0.181 1534	0.076 6592	0.078 5304
	13	0.990 1728	0.990 0384	0.165 7149	0.165 7148	0.069 9607	0.071 8374
	14	0.992 8214	0.992 6998	0.150 2286	0.150 2286	0.063 2421	0.065 1238
	15	-0.995 1831	-0.995 0742	+0.134 6990	+0.134 6990	+0.056 5054	+0.058 3915
	16	0.997 2568	0.997 1607	0.119 1301	0.119 1302	0.049 7524	0.051 6423
	17	0.999 0418	0.998 9586	0.103 5262	0.103 5263	0.042 9849	0.044 8781
	18	1.000 5372	1.000 4668	0.087 8915	0.087 8917	0.036 2047	0.038 1008
	19	1.001 7422	1.001 6846	0.072 2304	0.072 2305	0.029 4137	0.031 3120
	20	1.002 6560	1.002 6113	0.056 5470	0.056 5472	0.022 6138	0.024 5138
	21	-1.003 2778	-1.003 2460	+0.040 8459	+0.040 8461	+0.015 8068	+0.017 7079
	22	1.003 6069	1.003 5881	0.025 1313	0.025 1315	0.008 9947	0.010 8963
	23	1.003 6426	1.003 6367	+0.009 4078	+0.009 4081	+0.002 1793	+0.004 0810
	24	1.003 3843	1.003 3913	-0.006 3199	-0.006 3196	-0.004 6375	-0.002 7363
	25	1.002 8314	1.002 8513	0.022 0473	0.022 0470	0.011 4535	0.009 5534
	26	1.001 9834	1.002 0162	0.037 7695	0.037 7692	0.018 2668	0.016 3684
	27	-1.000 8399	-1.000 8857	-0.053 4816	-0.053 4812	-0.025 0752	-0.023 1790
	28	0.999 4008	0.999 4595	0.069 1785	0.069 1782	0.031 8767	0.029 9833
	29	0.997 6662	0.997 7377	0.084 8553	0.084 8549	0.038 6690	0.036 7790
	30	0.995 6362	0.995 7205	0.100 5068	0.100 5064	0.045 4501	0.043 5639
Oct.	1	-0.993 3114	-0.993 4086	-0.116 1280	-0.116 1275	-0.052 2175	-0.050 3358

SUN, 2019

EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2019.5 AND J 2000.0

Date		$X_{2019.5}$	$X_{2000.0}$	$Y_{2019.5}$	$Y_{2000.0}$	$Z_{2019.5}$	$Z_{2000.0}$
Oct.	1	-0.993 3114	-0.993 4086	-0.116 1280	-0.116 1275	-0.052 2175	-0.050 3358
	2	0.990 6926	0.990 8026	0.131 7139	0.131 7134	0.058 9693	0.057 0926
	3	0.987 7805	0.987 9033	0.147 2596	0.147 2591	0.065 7033	0.063 8321
	4	0.984 5762	0.984 7117	0.162 7603	0.162 7598	0.072 4173	0.070 5523
	5	0.981 0808	0.981 2290	0.178 2115	0.178 2109	0.079 1093	0.077 2510
	6	0.977 2954	0.977 4562	0.193 6085	0.193 6079	0.085 7773	0.083 9262
	7	-0.973 2212	-0.973 3946	-0.208 9468	-0.208 9461	-0.092 4193	-0.090 5760
	8	0.968 8594	0.969 0454	0.224 2219	0.224 2213	0.099 0334	0.097 1984
	9	0.964 2114	0.964 4099	0.239 4296	0.239 4289	0.105 6176	0.103 7914
	10	0.959 2785	0.959 4894	0.254 5655	0.254 5647	0.112 1700	0.110 3532
	11	0.954 0620	0.954 2853	0.269 6251	0.269 6244	0.118 6888	0.116 8819
	12	0.948 5634	0.948 7990	0.284 6043	0.284 6036	0.125 1720	0.123 3757
	13	-0.942 7841	-0.943 0318	-0.299 4989	-0.299 4981	-0.131 6179	-0.129 8325
	14	0.936 7255	0.936 9854	0.314 3046	0.314 3037	0.138 0245	0.136 2507
	15	0.930 3891	0.930 6611	0.329 0171	0.329 0163	0.144 3901	0.142 6284
	16	0.923 7765	0.924 0605	0.343 6323	0.343 6315	0.150 7129	0.148 9637
	17	0.916 8893	0.917 1852	0.358 1461	0.358 1452	0.156 9911	0.155 2550
	18	0.909 7289	0.910 0366	0.372 5540	0.372 5531	0.163 2227	0.161 5003
	19	-0.902 2970	-0.902 6164	-0.386 8520	-0.386 8511	-0.169 4061	-0.167 6978
	20	0.894 5952	0.894 9263	0.401 0358	0.401 0348	0.175 5395	0.173 8458
	21	0.886 6253	0.886 9679	0.415 1009	0.415 0999	0.181 6209	0.179 9423
	22	0.878 3890	0.878 7431	0.429 0431	0.429 0421	0.187 6485	0.185 9856
	23	0.869 8882	0.870 2536	0.442 8578	0.442 8568	0.193 6204	0.191 9736
	24	0.861 1249	0.861 5015	0.456 5407	0.456 5396	0.199 5348	0.197 9047
	25	-0.852 1012	-0.852 4889	-0.470 0871	-0.470 0860	-0.205 3896	-0.203 7766
	26	0.842 8194	0.843 2182	0.483 4924	0.483 4913	0.211 1830	0.209 5877
	27	0.833 2821	0.833 6917	0.496 7520	0.496 7509	0.216 9129	0.215 3357
	28	0.823 4920	0.823 9124	0.509 8615	0.509 8604	0.222 5774	0.221 0188
	29	0.813 4521	0.813 8831	0.522 8163	0.522 8152	0.228 1746	0.226 6350
	30	0.803 1655	0.803 6070	0.535 6121	0.535 6110	0.233 7025	0.232 1825
	31	-0.792 6356	-0.793 0874	-0.548 2448	-0.548 2436	-0.239 1593	-0.237 6593
Nov.	1	0.781 8656	0.782 3277	0.560 7102	0.560 7089	0.244 5433	0.243 0637
	2	0.770 8591	0.771 3312	0.573 0044	0.573 0032	0.249 8527	0.248 3940
	3	0.759 6195	0.760 1017	0.585 1238	0.585 1226	0.255 0857	0.253 6484
	4	0.748 1505	0.748 6424	0.597 0646	0.597 0634	0.260 2410	0.258 8254
	5	0.736 4556	0.736 9571	0.608 8233	0.608 8220	0.265 3167	0.263 9234
	6	-0.724 5383	-0.725 0494	-0.620 3964	-0.620 3951	-0.270 3115	-0.268 9408
	7	0.712 4023	0.712 9227	0.631 7804	0.631 7791	0.275 2239	0.273 8761
	8	0.700 0513	0.700 5808	0.642 9721	0.642 9708	0.280 0523	0.278 7280
	9	0.687 4888	0.688 0274	0.653 9682	0.653 9668	0.284 7953	0.283 4949
	10	0.674 7186	0.675 2660	0.664 7654	0.664 7640	0.289 4517	0.288 1755
	11	0.661 7442	0.662 3003	0.675 3606	0.675 3592	0.294 0199	0.292 7683
	12	-0.648 5696	-0.649 1342	-0.685 7507	-0.685 7493	-0.298 4987	-0.297 2721
	13	0.635 1982	0.635 7711	0.695 9327	0.695 9313	0.302 8868	0.301 6856
	14	0.621 6339	0.622 2150	0.705 9035	0.705 9021	0.307 1829	0.306 0074
	15	0.607 8802	0.608 4693	0.715 6601	0.715 6587	0.311 3856	0.310 2362
	16	-0.593 9411	-0.594 5380	-0.725 1995	-0.725 1980	-0.315 4938	-0.314 3709

SUN, 2019

EQUATORIAL RECTANGULAR CO-ORDINATES FOR 0^h TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2019.5 AND J 2000.0

Date		$X_{2019.5}$	$X_{2000.0}$	$Y_{2019.5}$	$Y_{2000.0}$	$Z_{2019.5}$	$Z_{2000.0}$
Nov.	16	-0.593 9411	-0.594 5380	-0.725 1995	-0.725 1980	-0.315 4938	-0.314 3709
	17	0.579 8202	0.580 4247	0.734 5186	0.734 5171	0.319 5062	0.318 4100
	18	0.565 5213	0.566 1333	0.743 6143	0.743 6129	0.323 4214	0.322 3524
	19	0.551 0484	0.551 6676	0.752 4837	0.752 4822	0.327 2382	0.326 1967
	20	0.536 4053	0.537 0317	0.761 1236	0.761 1221	0.330 9554	0.329 9416
	21	0.521 5963	0.522 2295	0.769 5309	0.769 5294	0.334 5715	0.333 5858
	22	-0.506 6256	-0.507 2655	-0.777 7026	-0.777 7010	-0.338 0853	-0.337 1280
	23	0.491 4975	0.492 1439	0.785 6355	0.785 6340	0.341 4955	0.340 5669
	24	0.476 2168	0.476 8694	0.793 3267	0.793 3252	0.344 8008	0.343 9012
	25	0.460 7880	0.461 4467	0.800 7733	0.800 7718	0.348 0000	0.347 1296
	26	0.445 2162	0.445 8808	0.807 9726	0.807 9710	0.351 0918	0.350 2509
	27	0.429 5063	0.430 1767	0.814 9218	0.814 9203	0.354 0751	0.353 2641
	28	-0.413 6636	-0.414 3394	-0.821 6187	-0.821 6171	-0.356 9489	-0.356 1678
	29	0.397 6933	0.398 3744	0.828 0609	0.828 0594	0.359 7120	0.358 9613
	30	0.381 6006	0.382 2867	0.834 2465	0.834 2449	0.362 3637	0.361 6434
Dec.	1	0.365 3907	0.366 0817	0.840 1734	0.840 1718	0.364 9030	0.364 2135
	2	0.349 0690	0.349 7646	0.845 8398	0.845 8382	0.367 3291	0.366 6705
	3	0.332 6405	0.333 3405	0.851 2443	0.851 2426	0.369 6413	0.369 0139
	4	-0.316 1106	-0.316 8148	-0.856 3850	-0.856 3834	-0.371 8390	-0.371 2429
	5	0.299 4844	0.300 1926	0.861 2608	0.861 2592	0.373 9214	0.373 3568
	6	0.282 7670	0.283 4790	0.865 8701	0.865 8685	0.375 8880	0.375 3551
	7	0.265 9637	0.266 6792	0.870 2117	0.870 2101	0.377 7383	0.377 2373
	8	0.249 0796	0.249 7984	0.874 2844	0.874 2828	0.379 4717	0.379 0027
	9	0.232 1198	0.232 8416	0.878 0872	0.878 0856	0.381 0878	0.380 6509
	10	-0.215 0892	-0.215 8140	-0.881 6190	-0.881 6174	-0.382 5862	-0.382 1816
	11	0.197 9931	0.198 7205	0.884 8789	0.884 8773	0.383 9664	0.383 5942
	12	0.180 8362	0.181 5661	0.887 8659	0.887 8643	0.385 2281	0.384 8885
	13	0.163 6237	0.164 3558	0.890 5791	0.890 5775	0.386 3710	0.386 0640
	14	0.146 3605	0.147 0945	0.893 0177	0.893 0161	0.387 3948	0.387 1204
	15	0.129 0514	0.129 7872	0.895 1808	0.895 1792	0.388 2990	0.388 0575
	16	-0.111 7015	-0.112 4388	-0.897 0675	-0.897 0659	-0.389 0834	-0.388 8747
	17	0.094 3158	0.095 0543	0.898 6769	0.898 6753	0.389 7476	0.389 5719
	18	0.076 8993	0.077 6389	0.900 0081	0.900 0065	0.390 2913	0.390 1486
	19	0.059 4572	0.060 1977	0.901 0604	0.901 0587	0.390 7142	0.390 6045
	20	0.041 9950	0.042 7360	0.901 8328	0.901 8312	0.391 0159	0.390 9393
	21	0.024 5179	0.025 2593	0.902 3247	0.902 3231	0.391 1961	0.391 1527
	22	-0.007 0316	-0.007 7732	-0.902 5356	-0.902 5339	-0.391 2547	-0.391 2444
	23	+0.010 4583	+0.009 7168	0.902 4649	0.902 4632	0.391 1914	0.391 2142
	24	0.027 9461	0.027 2049	0.902 1123	0.902 1107	0.391 0060	0.391 0620
	25	0.045 4259	0.044 6853	0.901 4778	0.901 4762	0.390 6985	0.390 7876
	26	0.062 8920	0.062 1521	0.900 5614	0.900 5598	0.390 2689	0.390 3911
	27	0.080 3384	0.079 5996	0.899 3634	0.899 3618	0.389 7173	0.389 8725
	28	+0.097 7595	+0.097 0220	-0.897 8841	-0.897 8825	-0.389 0438	-0.389 2320
	29	0.115 1495	0.114 4134	0.896 1242	0.896 1226	0.388 2486	0.388 4698
	30	0.132 5026	0.131 7683	0.894 0844	0.894 0828	0.387 3321	0.387 5862
	31	0.149 8133	0.149 0809	0.891 7655	0.891 7640	0.386 2946	0.386 5815
	32	+0.167 0761	+0.166 3458	-0.889 1685	-0.889 1670	-0.385 1365	-0.385 4561

SUN, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0	Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0
		°	°	°			°	°	°
Jan.	0	+2.69	-2.85	221.59	Feb.	15	-17.27	-6.81	335.89
	1	2.21	2.97	208.42		16	17.61	6.86	322.72
	2	1.72	3.09	195.25		17	17.94	6.90	309.55
	3	1.24	3.21	182.08		18	18.26	6.93	296.38
	4	0.75	3.32	168.91		19	18.58	6.97	283.21
	5	+0.27	3.43	155.74		20	18.89	7.01	270.04
	6	-0.22	-3.55	142.57		21	-19.20	-7.04	256.87
	7	0.70	3.66	129.40		22	19.50	7.07	243.70
	8	1.18	3.77	116.23		23	19.79	7.09	230.53
	9	1.66	3.88	103.06		24	20.08	7.12	217.36
	10	2.14	3.99	89.90		25	20.36	7.14	204.19
	11	2.62	4.09	76.73		26	20.63	7.16	191.02
	12	-3.10	-4.20	63.56		27	-20.90	-7.18	177.85
	13	3.57	4.30	50.39		28	21.17	7.20	164.68
	14	4.05	4.41	37.22	Mar.	1	21.43	7.21	151.51
	15	4.52	4.51	24.06		2	21.68	7.23	138.33
	16	4.98	4.61	10.89		3	21.92	7.24	125.16
	17	5.45	4.71	357.72		4	22.16	7.24	111.99
	18	-5.91	-4.81	344.55		5	-22.39	-7.25	98.82
	19	6.37	4.90	331.39		6	22.62	7.25	85.64
	20	6.83	5.00	318.22		7	22.84	7.25	72.47
	21	7.28	5.09	305.05		8	23.05	7.25	59.29
	22	7.73	5.18	291.88		9	23.26	7.25	46.12
	23	8.18	5.27	278.72		10	23.45	7.24	32.94
	24	-8.62	-5.36	265.55		11	-23.65	-7.23	19.76
	25	9.06	5.44	252.38		12	23.83	7.22	6.59
	26	9.50	5.53	239.22		13	24.01	7.21	353.41
	27	9.93	5.61	226.05		14	24.19	7.20	340.23
	28	10.36	5.69	212.88		15	24.35	7.18	327.05
	29	10.78	5.77	199.72		16	24.51	7.16	313.87
	30	-11.20	-5.85	186.55		17	-24.67	-7.14	300.69
	31	11.62	5.92	173.39		18	24.81	7.12	287.51
Feb.	1	12.03	5.99	160.22		19	24.95	7.09	274.32
	2	12.44	6.07	147.05		20	25.08	7.06	261.14
	3	12.84	6.13	133.89		21	25.21	7.03	247.96
	4	13.24	6.20	120.72		22	25.33	7.00	234.77
	5	-13.63	-6.27	107.56		23	-25.44	-6.97	221.59
	6	14.02	6.33	94.39		24	25.54	6.93	208.40
	7	14.40	6.39	81.22		25	25.64	6.89	195.21
	8	14.78	6.45	68.06		26	25.73	6.85	182.03
	9	15.15	6.51	54.89		27	25.81	6.81	168.84
	10	15.52	6.57	41.72		28	25.89	6.77	155.65
	11	-15.88	-6.62	28.56		29	-25.96	-6.72	142.46
	12	16.24	6.67	15.39		30	26.02	6.67	129.27
	13	16.59	6.72	2.22		31	26.08	6.62	116.08
	14	16.93	6.77	349.06	Apr.	1	26.13	6.57	102.89
	15	-17.27	-6.81	335.89		2	-26.17	-6.52	89.70

SUN, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0	Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0
		°	°	°			°	°	°
Apr.	1	-26.13	-6.57	102.89	May	17	-20.50	-2.50	215.23
	2	26.17	6.52	89.70		18	20.21	2.38	202.00
	3	26.20	6.46	76.50		19	19.91	2.27	188.78
	4	26.23	6.40	63.31		20	19.61	2.15	175.55
	5	26.25	6.34	50.12		21	19.31	2.03	162.32
	6	26.26	6.28	36.92		22	18.99	1.92	149.09
	7	-26.26	-6.22	23.73		23	-18.68	-1.80	135.86
	8	26.26	6.15	10.53		24	18.35	1.68	122.63
	9	26.25	6.09	357.33		25	18.02	1.56	109.40
	10	26.24	6.02	344.13		26	17.68	1.45	96.17
	11	26.21	5.95	330.93		27	17.34	1.33	82.94
	12	26.18	5.88	317.73		28	16.99	1.21	69.71
	13	-26.14	-5.80	304.53		29	-16.64	-1.09	56.47
	14	26.09	5.73	291.33		30	16.28	0.97	43.24
	15	26.04	5.65	278.13		31	15.92	0.85	30.01
	16	25.98	5.57	264.92	June	1	15.55	0.73	16.78
	17	25.91	5.49	251.72		2	15.18	0.61	3.54
	18	25.84	5.41	238.51		3	14.80	0.49	350.31
	19	-25.75	-5.33	225.31		4	-14.42	-0.36	337.08
	20	25.66	5.24	212.10		5	14.03	0.24	323.84
	21	25.57	5.16	198.89		6	13.64	0.12	310.61
	22	25.46	5.07	185.68		7	13.24	-0.00	297.37
	23	25.35	4.98	172.47		8	12.84	+0.12	284.14
	24	25.23	4.89	159.26		9	12.44	0.24	270.90
	25	-25.10	-4.80	146.05		10	-12.03	+0.36	257.67
	26	24.97	4.71	132.84		11	11.62	0.48	244.43
	27	24.82	4.61	119.63		12	11.20	0.60	231.19
	28	24.68	4.51	106.41		13	10.78	0.72	217.96
	29	24.52	4.42	93.20		14	10.36	0.84	204.72
	30	24.36	4.32	79.99		15	9.94	0.96	191.49
May	1	-24.18	-4.22	66.77		16	-9.51	+1.08	178.25
	2	24.01	4.12	53.55		17	9.08	1.20	165.01
	3	23.82	4.02	40.34		18	8.65	1.32	151.77
	4	23.63	3.92	27.12		19	8.21	1.44	138.54
	5	23.43	3.81	13.90		20	7.77	1.55	125.30
	6	23.22	3.71	0.68		21	7.33	1.67	112.06
	7	-23.01	-3.60	347.46		22	-6.89	+1.79	98.82
	8	22.79	3.49	334.24		23	6.45	1.90	85.59
	9	22.56	3.39	321.02		24	6.00	2.02	72.35
	10	22.33	3.28	307.80		25	5.55	2.14	59.11
	11	22.08	3.17	294.58		26	5.10	2.25	45.88
	12	21.84	3.06	281.36		27	4.66	2.36	32.64
	13	-21.58	-2.95	268.13		28	-4.20	+2.48	19.40
	14	21.32	2.84	254.91		29	3.75	2.59	6.17
	15	21.05	2.72	241.68		30	3.30	2.70	352.93
	16	20.78	2.61	228.46	July	1	2.85	2.81	339.69
	17	-20.50	-2.50	215.23		2	-2.39	+2.93	326.46

SUN, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0	Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0
		°	°	°			°	°	°
July	1	-2.85	+2.81	339.69	Aug.	16	+16.20	+6.67	91.17
	2	2.39	2.93	326.46		17	16.53	6.71	77.95
	3	1.94	3.04	313.22		18	16.86	6.76	64.73
	4	1.49	3.14	299.99		19	17.19	6.80	51.51
	5	1.03	3.25	286.75		20	17.51	6.84	38.30
	6	0.58	3.36	273.52		21	17.82	6.88	25.08
	7	-0.13	+3.47	260.28		22	+18.13	+6.92	11.86
	8	+0.33	3.57	247.05		23	18.44	6.96	358.65
	9	0.78	3.68	233.81		24	18.74	6.99	345.44
	10	1.23	3.78	220.58		25	19.04	7.02	332.22
	11	1.68	3.88	207.34		26	19.33	7.05	319.01
	12	2.13	3.98	194.11		27	19.61	7.08	305.80
	13	+2.57	+4.08	180.88		28	+19.89	+7.10	292.58
	14	3.02	4.18	167.64		29	20.16	7.13	279.37
	15	3.46	4.28	154.41		30	20.43	7.15	266.16
	16	3.91	4.38	141.17		31	20.70	7.17	252.95
	17	4.35	4.47	127.94	Sept.	1	20.96	7.19	239.74
	18	4.79	4.57	114.71		2	21.21	7.20	226.53
	19	+5.22	+4.66	101.48		3	+21.46	+7.21	213.32
	20	5.66	4.75	88.25		4	21.70	7.23	200.12
	21	6.09	4.84	75.01		5	21.93	7.24	186.91
	22	6.52	4.93	61.78		6	22.16	7.24	173.70
	23	6.95	5.02	48.55		7	22.39	7.25	160.49
	24	7.37	5.11	35.32		8	22.61	7.25	147.29
	25	+7.79	+5.19	22.09		9	+22.82	+7.25	134.08
	26	8.21	5.27	8.86		10	23.03	7.25	120.88
	27	8.63	5.36	355.64		11	23.23	7.25	107.67
	28	9.04	5.44	342.41		12	23.42	7.24	94.47
	29	9.45	5.52	329.18		13	23.61	7.24	81.26
	30	9.86	5.59	315.95		14	23.79	7.23	68.06
	31	+10.26	+5.67	302.73		15	+23.97	+7.21	54.85
Aug.	1	10.67	5.75	289.50		16	24.14	7.20	41.65
	2	11.06	5.82	276.28		17	24.30	7.18	28.45
	3	11.46	5.89	263.05		18	24.46	7.17	15.25
	4	11.84	5.96	249.83		19	24.61	7.15	2.05
	5	12.23	6.03	236.60		20	24.76	7.12	348.85
	6	+12.61	+6.10	223.38		21	+24.90	+7.10	335.65
	7	12.99	6.16	210.15		22	25.03	7.07	322.45
	8	13.36	6.22	196.93		23	25.16	7.05	309.25
	9	13.73	6.28	183.71		24	25.28	7.02	296.05
	10	14.10	6.34	170.49		25	25.39	6.98	282.85
	11	14.46	6.40	157.27		26	25.50	6.95	269.65
	12	+14.82	+6.46	144.05		27	+25.60	+6.91	256.45
	13	15.17	6.51	130.82		28	25.69	6.87	243.26
	14	15.52	6.57	117.60		29	25.78	6.83	230.06
	15	15.86	6.62	104.39		30	25.85	6.79	216.86
	16	+16.20	+6.67	91.17	Oct.	1	+25.93	+6.74	203.67

SUN, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0	Date		Position Angle of Axis P	Heliographic Latitude B_0	Heliographic Longitude L_0
		°	°	°			°	°	°
Oct.	1	+25.93	+6.74	203.67	Nov.	16	+21.21	+2.79	316.98
	2	25.99	6.70	190.47		17	20.93	2.67	303.80
	3	26.05	6.65	177.28		18	20.64	2.56	290.61
	4	26.10	6.60	164.08		19	20.34	2.44	277.43
	5	26.15	6.55	150.89		20	20.04	2.32	264.25
	6	26.18	6.49	137.69		21	19.73	2.19	251.07
	7	+26.22	+6.43	124.50		22	+19.41	+2.07	237.89
	8	26.24	6.38	111.31		23	19.08	1.95	224.71
	9	26.25	6.31	98.11		24	18.75	1.83	211.53
	10	26.26	6.25	84.92		25	18.41	1.70	198.35
	11	26.26	6.19	71.73		26	18.06	1.58	185.17
	12	26.26	6.12	58.53		27	17.71	1.45	171.99
	13	+26.24	+6.05	45.34		28	+17.34	+1.33	158.81
	14	26.22	5.98	32.15		29	16.98	1.20	145.63
	15	26.20	5.91	18.96		30	16.61	1.08	132.45
	16	26.16	5.84	5.77	Dec.	1	16.23	0.95	119.27
	17	26.12	5.76	352.58		2	15.84	0.82	106.09
	18	26.07	5.69	339.38		3	15.45	0.70	92.91
	19	+26.01	+5.61	326.19		4	+15.05	+0.57	79.73
	20	25.94	5.53	313.00		5	14.65	0.44	66.56
	21	25.87	5.44	299.81		6	14.24	0.31	53.38
	22	25.79	5.36	286.63		7	13.83	0.18	40.20
	23	25.70	5.27	273.44		8	13.41	+0.06	27.02
	24	25.60	5.19	260.25		9	12.99	-0.07	13.85
	25	+25.49	+5.10	247.06		10	+12.56	-0.20	0.67
	26	25.38	5.01	233.87		11	12.13	0.33	347.49
	27	25.26	4.92	220.68		12	11.69	0.46	334.32
	28	25.13	4.82	207.50		13	11.25	0.58	321.14
	29	25.00	4.73	194.31		14	10.81	0.71	307.96
	30	24.85	4.63	181.12		15	10.36	0.84	294.79
	31	+24.70	+4.53	167.94		16	+9.91	-0.97	281.61
Nov.	1	24.54	4.43	154.75		17	9.45	1.09	268.44
	2	24.37	4.33	141.56		18	8.99	1.22	255.26
	3	24.20	4.23	128.38		19	8.53	1.35	242.09
	4	24.02	4.13	115.19		20	8.06	1.47	228.92
	5	23.83	4.02	102.01		21	7.60	1.60	215.74
	6	+23.63	+3.92	88.82		22	+7.12	-1.73	202.57
	7	23.42	3.81	75.64		23	6.65	1.85	189.40
	8	23.21	3.70	62.45		24	6.18	1.97	176.22
	9	22.98	3.59	49.27		25	5.70	2.10	163.05
	10	22.75	3.48	36.08		26	5.22	2.22	149.88
	11	22.52	3.37	22.90		27	4.74	2.34	136.71
	12	+22.27	+3.25	9.71		28	+4.26	-2.46	123.54
	13	22.02	3.14	356.53		29	3.78	2.58	110.37
	14	21.76	3.03	343.35		30	3.29	2.70	97.19
	15	21.49	2.91	330.16		31	2.81	2.82	84.02
	16	+21.21	+2.79	316.98		32	+2.32	-2.94	70.85

MOON, 2019

UNIVERSAL TIME

PHASES OF THE MOON

Lunation	New Moon	d	h	m	First Quarter	d	h	m	Full Moon	d	h	m	Last Quarter	d	h	m
1187	Dec.	7	07	20	Dec.	15	11	49	Dec.	22	17	49	Dec.	29	09	34
1188	Jan.	6	01	28	Jan.	14	06	46	Jan.	21	05	16	Jan.	27	21	10
1189	Feb.	4	21	04	Feb.	12	22	26	Feb.	19	15	54	Feb.	26	11	28
1190	Mar.	6	16	04	Mar.	14	10	27	Mar.	21	01	43	Mar.	28	04	10
1191	Apr.	5	08	50	Apr.	12	19	46	Apr.	19	11	12	Apr.	26	22	18
1192	May	4	22	45	May	12	01	12	May	18	21	11	May	26	16	34
1193	Jun.	3	10	02	Jun.	10	05	59	Jun.	17	08	31	Jun.	25	09	46
1194	Jul.	2	19	16	Jul.	9	10	55	Jul.	16	21	38	Jul.	25	01	18
1195	Aug.	1	03	12	Aug.	7	17	31	Aug.	15	12	29	Aug.	23	14	56
1196	Aug.	30	10	37	Sep.	6	03	10	Sep.	14	04	33	Sep.	22	02	41
1197	Sep.	28	18	26	Oct.	5	16	47	Oct.	13	21	08	Oct.	21	12	39
1198	Oct.	28	03	38	Nov.	4	10	23	Nov.	12	13	34	Nov.	19	21	11
1199	Nov.	26	15	06	Dec.	4	06	58	Dec.	12	05	12	Dec.	19	04	57
1200	Dec.	26	05	13	Jan.	3	04	45	Jan.	10	19	21	Jan.	17	12	58

MOON AT PERIGEE

	d	h		d	h		d	h
Dec.	24	10	May	13	22	Sep.	28	02
Jan.	21	20	Jun.	7	23	Oct.	26	11
Feb.	19	09	Jul.	5	05	Nov.	23	08
Mar.	19	20	Aug.	2	08	Dec.	18	20
Apr.	16	22	Aug.	30	16	Jan.	13	20

MOON AT APOGEE

	d	h		d	h		d	h
Dec.	12	12	Apr.	28	18	Sep.	13	14
Jan.	9	04	May	26	13	Oct.	10	18
Feb.	5	09	Jun.	23	08	Nov.	7	09
Mar.	4	11	Jul.	20	24	Dec.	5	04
Apr.	1	00	Aug.	17	11	Jan.	2	02

MOON, 2019
MEAN EQUATOR, ORBIT, LONGITUDE AND ELONGATION

Date		Mean Equator			Orbit Perigee			Node			Mean Longitude			Mean Elongation
		i	Δ	Ω'	Γ'			Ω			☾			D
		°	°	°	°	'	"	°	'	"	°	'	"	°
Jan.	1	24.186	300.623	356.661	136	26	15.4	117	34	19.1	215	55	11.7	295.554
	11	24.174	300.110	356.644	137	33	05.9	117	02	32.8	347	41	02.0	57.461
	21	24.162	299.596	356.626	138	39	56.4	116	30	46.5	119	26	52.3	179.369
	31	24.149	299.082	356.609	139	46	47.0	115	59	00.1	251	12	42.5	301.276
Feb.	10	24.137	298.568	356.592	140	53	37.5	115	27	13.8	22	58	32.8	63.184
	20	24.124	298.054	356.575	142	00	28.0	114	55	27.4	154	44	23.1	185.091
Mar.	2	24.111	297.540	356.559	143	07	18.5	114	23	41.1	286	30	13.3	306.999
	12	24.099	297.025	356.543	144	14	09.1	113	51	54.8	58	16	03.6	68.906
	22	24.086	296.510	356.527	145	20	59.6	113	20	08.4	190	01	53.9	190.814
Apr.	1	24.073	295.995	356.512	146	27	50.1	112	48	22.1	321	47	44.2	312.721
	11	24.060	295.479	356.497	147	34	40.6	112	16	35.8	93	33	34.4	74.629
	21	24.047	294.964	356.482	148	41	31.1	111	44	49.4	225	19	24.7	196.536
May	1	24.035	294.448	356.467	149	48	21.7	111	13	03.1	357	05	15.0	318.444
	11	24.022	293.931	356.453	150	55	12.2	110	41	16.8	128	51	05.3	80.351
	21	24.009	293.415	356.439	152	02	02.7	110	09	30.4	260	36	55.5	202.258
	31	23.996	292.898	356.425	153	08	53.2	109	37	44.1	32	22	45.8	324.166
June	10	23.982	292.381	356.412	154	15	43.8	109	05	57.8	164	08	36.1	86.073
	20	23.969	291.863	356.398	155	22	34.3	108	34	11.4	295	54	26.3	207.981
	30	23.956	291.346	356.385	156	29	24.8	108	02	25.1	67	40	16.6	329.888
July	10	23.943	290.828	356.373	157	36	15.3	107	30	38.8	199	26	06.9	91.796
	20	23.930	290.310	356.361	158	43	05.9	106	58	52.4	331	11	57.2	213.703
	30	23.916	289.791	356.349	159	49	56.4	106	27	06.1	102	57	47.4	335.611
Aug.	9	23.903	289.273	356.337	160	56	46.9	105	55	19.8	234	43	37.7	97.518
	19	23.889	288.754	356.325	162	03	37.4	105	23	33.4	6	29	28.0	219.426
	29	23.876	288.235	356.314	163	10	27.9	104	51	47.1	138	15	18.3	341.333
Sept.	8	23.862	287.715	356.303	164	17	18.5	104	20	00.8	270	01	08.5	103.241
	18	23.849	287.196	356.293	165	24	09.0	103	48	14.4	41	46	58.8	225.148
	28	23.835	286.676	356.283	166	30	59.5	103	16	28.1	173	32	49.1	347.056
Oct.	8	23.822	286.155	356.273	167	37	50.0	102	44	41.8	305	18	39.3	108.963
	18	23.808	285.635	356.263	168	44	40.6	102	12	55.4	77	04	29.6	230.871
	28	23.794	285.114	356.254	169	51	31.1	101	41	09.1	208	50	19.9	352.778
Nov.	7	23.780	284.593	356.244	170	58	21.6	101	09	22.7	340	36	10.2	114.686
	17	23.766	284.072	356.236	172	05	12.1	100	37	36.4	112	22	00.4	236.593
	27	23.753	283.550	356.227	173	12	02.6	100	05	50.1	244	07	50.7	358.501
Dec.	7	23.739	283.028	356.219	174	18	53.2	99	34	03.7	15	53	41.0	120.408
	17	23.725	282.506	356.211	175	25	43.7	99	02	17.4	147	39	31.3	242.316
	27	23.711	281.984	356.203	176	32	34.2	98	30	31.1	279	25	21.5	4.223
	37	23.696	281.462	356.196	177	39	24.7	97	58	44.7	51	11	11.8	126.131
	47	23.682	280.939	356.189	178	46	15.3	97	26	58.4	182	57	02.1	248.038

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Jan.	0.0	209	13	29.1	+5	15	53.4	2.5596	15	35.91
	0.5	215	49	34.3	5	12	20.4	2.5738	15	30.75
	1.0	222	21	35.3	5	04	45.5	2.5875	15	25.82
	1.5	228	49	43.7	4	53	21.3	2.6006	15	21.15
	2.0	235	14	11.4	4	38	22.5	2.6131	15	16.73
	2.5	241	35	10.3	4	20	05.2	2.6250	15	12.57
	3.0	247	52	51.9	+3	58	47.1	2.6363	15	08.66
	3.5	254	07	27.5	3	34	47.2	2.6470	15	05.00
	4.0	260	19	08.0	3	08	25.5	2.6570	15	01.59
	4.5	266	28	04.2	2	40	02.8	2.6664	14	58.42
	5.0	272	34	27.0	2	10	00.3	2.6751	14	55.49
	5.5	278	38	27.3	1	38	39.7	2.6831	14	52.81
	6.0	284	40	16.8	+1	06	22.7	2.6904	14	50.39
	6.5	290	40	07.7	0	33	30.9	2.6969	14	48.24
	7.0	296	38	13.3	+0	00	25.7	2.7026	14	46.38
	7.5	302	34	48.2	-0	32	32.2	2.7073	14	44.84
	8.0	308	30	08.4	1	05	02.7	2.7109	14	43.65
	8.5	314	24	31.5	1	36	46.6	2.7134	14	42.84
	9.0	320	18	17.1	-2	07	25.3	2.7146	14	42.45
	9.5	326	11	46.6	2	36	41.4	2.7144	14	42.51
	10.0	332	05	23.4	3	04	17.9	2.7127	14	43.06
	10.5	337	59	32.9	3	29	59.2	2.7094	14	44.14
	11.0	343	54	42.6	3	53	30.1	2.7044	14	45.79
	11.5	349	51	21.4	4	14	36.1	2.6976	14	48.02
	12.0	355	50	00.3	-4	33	03.3	2.6889	14	50.88
	12.5	1	51	11.3	4	48	38.4	2.6784	14	54.38
	13.0	7	55	27.7	5	01	08.5	2.6661	14	58.52
	13.5	14	03	23.2	5	10	21.1	2.6519	15	03.31
	14.0	20	15	31.4	5	16	04.3	2.6361	15	08.74
	14.5	26	32	25.4	5	18	06.8	2.6187	15	14.78
	15.0	32	54	36.6	-5	16	18.3	2.5999	15	21.39
	15.5	39	22	34.1	5	10	29.8	2.5800	15	28.49
	16.0	45	56	43.5	5	00	34.1	2.5593	15	36.01
	16.5	52	37	25.4	4	46	26.6	2.5381	15	43.84
	17.0	59	24	54.6	4	28	05.9	2.5167	15	51.84
	17.5	66	19	18.7	4	05	34.9	2.4957	15	59.87
	18.0	73	20	36.8	-3	39	01.6	2.4754	16	07.74
	18.5	80	28	38.2	3	08	39.9	2.4563	16	15.27
	19.0	87	43	02.1	2	34	50.5	2.4388	16	22.25
	19.5	95	03	16.9	1	58	01.2	2.4234	16	28.49
	20.0	102	28	40.5	1	18	46.7	2.4105	16	33.79
	20.5	109	58	20.5	-0	37	48.3	2.4004	16	37.99
	21.0	117	31	16.1	+0	04	07.3	2.3933	16	40.94
	21.5	125	06	19.7	0	46	10.1	2.3894	16	42.56
	22.0	132	42	19.3	1	27	28.2	2.3889	16	42.79
	22.5	140	18	01.5	2	07	10.9	2.3916	16	41.65
	23.0	147	52	13.8	+2	44	30.4	2.3975	16	39.20

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Jan.	23.0	147	52	13.8	+2	44	30.4	2.3975	16	39.20
	23.5	155	23	48.0	3	18	44.1	2.4063	16	35.54
	24.0	162	51	42.4	3	49	16.3	2.4177	16	30.82
	24.5	170	15	03.3	4	15	38.6	2.4315	16	25.21
	25.0	177	33	07.3	4	37	31.0	2.4472	16	18.90
	25.5	184	45	21.0	4	54	41.1	2.4643	16	12.08
	26.0	191	51	21.8	+5	07	03.6	2.4826	16	04.92
	26.5	198	50	56.9	5	14	39.6	2.5016	15	57.61
	27.0	205	44	03.1	5	17	35.4	2.5208	15	50.29
	27.5	212	30	45.1	5	16	01.4	2.5401	15	43.10
	28.0	219	11	14.3	5	10	11.0	2.5590	15	36.13
	28.5	225	45	47.9	5	00	20.3	2.5773	15	29.49
	29.0	232	14	47.0	+4	46	46.6	2.5947	15	23.23
	29.5	238	38	35.8	4	29	48.5	2.6112	15	17.39
	30.0	244	57	40.5	4	09	45.2	2.6266	15	12.02
	30.5	251	12	28.2	3	46	56.5	2.6408	15	07.11
	31.0	257	23	26.1	3	21	42.1	2.6538	15	02.69
	31.5	263	31	01.2	2	54	22.1	2.6655	14	58.73
Feb.	1.0	269	35	39.5	+2	25	16.7	2.6759	14	55.22
	1.5	275	37	45.9	1	54	46.1	2.6851	14	52.16
	2.0	281	37	43.8	1	23	10.5	2.6930	14	49.52
	2.5	287	35	55.2	0	50	50.1	2.6998	14	47.28
	3.0	293	32	40.5	+0	18	05.2	2.7055	14	45.43
	3.5	299	28	18.6	-0	14	44.1	2.7101	14	43.94
	4.0	305	23	07.2	-0	47	18.0	2.7135	14	42.81
	4.5	311	17	22.9	1	19	16.9	2.7159	14	42.02
	5.0	317	11	21.2	1	50	21.7	2.7173	14	41.58
	5.5	323	05	17.4	2	20	13.7	2.7176	14	41.48
	6.0	328	59	26.2	2	48	35.1	2.7169	14	41.73
	6.5	334	54	02.5	3	15	08.5	2.7150	14	42.34
	7.0	340	49	21.7	-3	39	37.8	2.7119	14	43.33
	7.5	346	45	39.5	4	01	47.7	2.7077	14	44.71
	8.0	352	43	12.8	4	21	23.7	2.7022	14	46.52
	8.5	358	42	19.7	4	38	12.5	2.6953	14	48.77
	9.0	4	43	19.6	4	52	02.1	2.6871	14	51.49
	9.5	10	46	33.3	5	02	41.2	2.6774	14	54.70
	10.0	16	52	23.1	-5	09	59.7	2.6664	14	58.43
	10.5	23	01	12.8	5	13	48.9	2.6538	15	02.68
	11.0	29	13	27.5	5	14	01.0	2.6398	15	07.46
	11.5	35	29	33.4	5	10	29.6	2.6244	15	12.78
	12.0	41	49	57.0	5	03	09.7	2.6077	15	18.62
	12.5	48	15	05.1	4	51	58.3	2.5899	15	24.95
	13.0	54	45	23.7	-4	36	54.2	2.5711	15	31.73
	13.5	61	21	17.3	4	17	58.8	2.5515	15	38.89
	14.0	68	03	07.9	3	55	16.7	2.5314	15	46.34
	14.5	74	51	13.3	3	28	55.9	2.5111	15	53.98
	15.0	81	45	46.6	-2	59	09.1	2.4910	16	01.68

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude °	'	"	Apparent Latitude °	'	"	True Geocentric Distance (A. U.) (X 10^{-3})	Semi Diameter '	"
Feb.	15.0	81	45	46.6	-2	59	09.1	2.4910	16	01.68
	15.5	88	46	54.1	2	26	13.7	2.4715	16	09.28
	16.0	95	54	34.0	1	50	32.7	2.4529	16	16.60
	16.5	103	08	35.2	1	12	35.3	2.4358	16	23.45
	17.0	110	28	36.3	-0	32	56.3	2.4206	16	29.64
	17.5	117	54	04.1	+0	07	43.6	2.4076	16	34.97
	18.0	125	24	14.4	+0	48	39.2	2.3973	16	39.25
	18.5	132	58	11.7	1	29	01.7	2.3899	16	42.33
	19.0	140	34	50.5	2	08	01.1	2.3858	16	44.09
	19.5	148	12	57.6	2	44	47.9	2.3849	16	44.46
	20.0	155	51	14.7	3	18	35.9	2.3874	16	43.40
	20.5	163	28	21.2	3	48	44.0	2.3932	16	40.96
	21.0	171	02	58.3	+4	14	38.6	2.4022	16	37.22
	21.5	178	33	52.1	4	35	54.1	2.4141	16	32.30
	22.0	185	59	56.5	4	52	14.2	2.4286	16	26.39
	22.5	193	20	15.8	5	03	31.3	2.4453	16	19.66
	23.0	200	34	06.3	5	09	45.9	2.4637	16	12.32
	23.5	207	40	56.9	5	11	05.8	2.4835	16	04.57
	24.0	214	40	29.2	+5	07	44.1	2.5042	15	56.61
	24.5	221	32	36.7	4	59	58.5	2.5253	15	48.61
	25.0	228	17	23.7	4	48	09.6	2.5465	15	40.73
	25.5	234	55	03.8	4	32	39.6	2.5673	15	33.11
	26.0	241	25	58.2	4	13	51.7	2.5874	15	25.85
	26.5	247	50	34.3	3	52	09.3	2.6065	15	19.05
	27.0	254	09	23.6	+3	27	55.4	2.6245	15	12.77
	27.5	260	23	00.9	3	01	32.5	2.6410	15	07.06
	28.0	266	32	02.8	2	33	22.3	2.6560	15	01.94
	28.5	272	37	06.5	2	03	45.6	2.6693	14	57.43
Mar.	1.0	278	38	49.1	1	33	02.8	2.6810	14	53.53
	1.5	284	37	46.7	1	01	33.4	2.6909	14	50.24
	2.0	290	34	34.2	+0	29	36.5	2.6991	14	47.52
	2.5	296	29	44.6	-0	02	29.0	2.7057	14	45.38
	3.0	302	23	48.4	0	34	24.8	2.7106	14	43.76
	3.5	308	17	14.0	1	05	52.7	2.7140	14	42.65
	4.0	314	10	27.1	1	36	34.5	2.7160	14	42.02
	4.5	320	03	50.8	2	06	12.6	2.7166	14	41.83
	5.0	325	57	45.5	-2	34	29.2	2.7159	14	42.05
	5.5	331	52	29.5	3	01	07.2	2.7140	14	42.65
	6.0	337	48	18.3	3	25	49.8	2.7110	14	43.62
	6.5	343	45	25.8	3	48	21.0	2.7070	14	44.92
	7.0	349	44	03.7	4	08	25.3	2.7021	14	46.55
	7.5	355	44	22.8	4	25	48.6	2.6961	14	48.50
	8.0	1	46	32.5	-4	40	17.5	2.6893	14	50.75
	8.5	7	50	41.9	4	51	40.4	2.6816	14	53.32
	9.0	13	56	59.8	4	59	47.0	2.6730	14	56.19
	9.5	20	05	35.6	5	04	28.5	2.6635	14	59.37
	10.0	26	16	39.2	-5	05	38.3	2.6532	15	02.89

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Mar.	10.0	26	16	39.2	-5	05	38.3	2.6532	15	02.89
	10.5	32	30	21.6	5	03	11.2	2.6419	15	06.73
	11.0	38	46	55.1	4	57	04.4	2.6298	15	10.92
	11.5	45	06	33.7	4	47	17.0	2.6168	15	15.46
	12.0	51	29	32.7	4	33	50.2	2.6029	15	20.34
	12.5	57	56	08.9	4	16	47.8	2.5882	15	25.56
	13.0	64	26	40.3	-3	56	15.8	2.5728	15	31.11
	13.5	71	01	25.5	3	32	23.1	2.5567	15	36.94
	14.0	77	40	43.3	3	05	21.7	2.5402	15	43.03
	14.5	84	24	51.5	2	35	26.5	2.5235	15	49.31
	15.0	91	14	06.1	2	02	56.2	2.5066	15	55.69
	15.5	98	08	40.0	1	28	13.4	2.4899	16	02.08
	16.0	105	08	41.7	-0	51	44.6	2.4738	16	08.36
	16.5	112	14	13.6	-0	14	00.6	2.4585	16	14.40
	17.0	119	25	10.6	+0	24	23.7	2.4443	16	20.05
	17.5	126	41	18.7	1	02	49.9	2.4317	16	25.14
	18.0	134	02	14.0	1	40	36.4	2.4209	16	29.52
	18.5	141	27	21.7	2	16	59.8	2.4123	16	33.04
	19.0	148	55	56.3	+2	51	16.3	2.4063	16	35.54
	19.5	156	27	02.1	3	22	43.2	2.4029	16	36.93
	20.0	163	59	34.5	3	50	41.4	2.4025	16	37.11
	20.5	171	32	22.2	4	14	36.4	2.4050	16	36.06
	21.0	179	04	10.5	4	34	00.6	2.4105	16	33.77
	21.5	186	33	44.0	4	48	34.3	2.4190	16	30.31
	22.0	193	59	50.5	+4	58	06.3	2.4301	16	25.76
	22.5	201	21	24.1	5	02	34.0	2.4438	16	20.25
	23.0	208	37	27.7	5	02	02.9	2.4596	16	13.94
	23.5	215	47	15.4	4	56	45.4	2.4772	16	07.02
	24.0	222	50	13.5	4	46	59.5	2.4962	15	59.65
	24.5	229	46	00.8	4	33	07.7	2.5162	15	52.03
	25.0	236	34	28.3	+4	15	35.1	2.5368	15	44.32
	25.5	243	15	38.5	3	54	48.1	2.5574	15	36.69
	26.0	249	49	43.7	3	31	13.9	2.5778	15	29.28
	26.5	256	17	04.8	3	05	19.2	2.5976	15	22.22
	27.0	262	38	09.6	2	37	29.5	2.6164	15	15.59
	27.5	268	53	31.1	2	08	09.4	2.6339	15	09.50
	28.0	275	03	46.4	+1	37	41.8	2.6500	15	03.99
	28.5	281	09	35.0	1	06	28.3	2.6643	14	59.11
	29.0	287	11	37.9	0	34	49.2	2.6769	14	54.90
	29.5	293	10	36.5	+0	03	03.6	2.6875	14	51.36
	30.0	299	07	12.1	-0	28	30.5	2.6961	14	48.51
	30.5	305	02	04.6	0	59	35.6	2.7028	14	46.32
	31.0	310	55	52.5	-1	29	54.9	2.7074	14	44.79
	31.5	316	49	12.2	1	59	12.0	2.7102	14	43.89
Apr.	1.0	322	42	37.3	2	27	10.8	2.7111	14	43.59
	1.5	328	36	38.8	2	53	35.4	2.7103	14	43.86
	2.0	334	31	44.6	-3	18	10.0	2.7079	14	44.64

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Apr.	1.0	322	42	37.3	-2	27	10.8	2.7111	14	43.59
	1.5	328	36	38.8	2	53	35.4	2.7103	14	43.86
	2.0	334	31	44.6	3	18	10.0	2.7079	14	44.64
	2.5	340	28	19.2	3	40	39.2	2.7040	14	45.91
	3.0	346	26	43.5	4	00	47.9	2.6988	14	47.61
	3.5	352	27	15.1	4	18	21.6	2.6925	14	49.71
	4.0	358	30	08.2	-4	33	06.4	2.6851	14	52.15
	4.5	4	35	33.6	4	44	49.4	2.6769	14	54.89
	5.0	10	43	39.0	4	53	19.3	2.6679	14	57.90
	5.5	16	54	29.7	4	58	26.0	2.6583	15	01.14
	6.0	23	08	08.3	5	00	01.5	2.6482	15	04.57
	6.5	29	24	36.1	4	58	00.0	2.6377	15	08.17
	7.0	35	43	52.9	-4	52	18.2	2.6269	15	11.92
	7.5	42	05	58.2	4	42	55.3	2.6158	15	15.79
	8.0	48	30	51.5	4	29	53.5	2.6044	15	19.78
	8.5	54	58	33.0	4	13	17.8	2.5929	15	23.88
	9.0	61	29	03.7	3	53	16.4	2.5812	15	28.07
	9.5	68	02	26.5	3	30	00.3	2.5693	15	32.36
	10.0	74	38	45.7	-3	03	43.6	2.5574	15	36.72
	10.5	81	18	07.4	2	34	43.4	2.5453	15	41.15
	11.0	88	00	38.9	2	03	19.6	2.5332	15	45.64
	11.5	94	46	28.9	1	29	55.1	2.5212	15	50.16
	12.0	101	35	46.1	0	54	55.3	2.5093	15	54.66
	12.5	108	28	39.1	-0	18	48.6	2.4976	15	59.12
	13.0	115	25	14.8	+0	17	54.6	2.4864	16	03.46
	13.5	122	25	37.3	0	54	41.2	2.4757	16	07.62
	14.0	129	29	46.9	1	30	56.6	2.4658	16	11.52
	14.5	136	37	38.5	2	06	04.6	2.4568	16	15.06
	15.0	143	49	00.3	2	39	28.3	2.4491	16	18.14
	15.5	151	03	33.5	3	10	31.3	2.4427	16	20.67
	16.0	158	20	50.6	+3	38	38.2	2.4381	16	22.54
	16.5	165	40	16.3	4	03	16.1	2.4353	16	23.66
	17.0	173	01	07.1	4	23	56.0	2.4346	16	23.96
	17.5	180	22	32.7	4	40	13.8	2.4360	16	23.37
	18.0	187	43	37.6	4	51	51.5	2.4398	16	21.86
	18.5	195	03	23.1	4	58	37.9	2.4458	16	19.44
	19.0	202	20	50.0	+5	00	29.4	2.4541	16	16.13
	19.5	209	35	00.9	4	57	29.3	2.4646	16	11.98
	20.0	216	45	03.1	4	49	48.1	2.4770	16	07.09
	20.5	223	50	10.6	4	37	42.2	2.4913	16	01.57
	21.0	230	49	45.5	4	21	33.0	2.5070	15	55.53
	21.5	237	43	20.0	4	01	45.5	2.5239	15	49.12
	22.0	244	30	36.0	+3	38	47.2	2.5417	15	42.49
	22.5	251	11	25.6	3	13	06.9	2.5600	15	35.77
	23.0	257	45	50.5	2	45	13.6	2.5783	15	29.10
	23.5	264	14	01.1	2	15	35.4	2.5965	15	22.61
	24.0	270	36	15.6	+1	44	39.4	2.6140	15	16.41

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Apr.	24.0	270	36	15.6	+1	44	39.4	2.6140	15	16.41
	24.5	276	52	58.7	1	12	51.3	2.6307	15	10.62
	25.0	283	04	40.4	0	40	34.6	2.6461	15	05.30
	25.5	289	11	55.0	+0	08	11.2	2.6601	15	00.54
	26.0	295	15	19.8	-0	23	58.6	2.6724	14	56.39
	26.5	301	15	34.2	0	55	36.2	2.6829	14	52.90
	27.0	307	13	19.0	-1	26	24.3	2.6913	14	50.09
	27.5	313	09	15.2	1	56	06.6	2.6977	14	47.98
	28.0	319	04	03.9	2	24	27.6	2.7020	14	46.57
	28.5	324	58	25.0	2	51	12.7	2.7042	14	45.86
	29.0	330	52	57.1	3	16	07.3	2.7042	14	45.84
	29.5	336	48	16.9	3	38	57.6	2.7023	14	46.48
	30.0	342	44	58.5	-3	59	29.6	2.6984	14	47.75
	30.5	348	43	33.3	4	17	29.8	2.6928	14	49.61
May	1.0	354	44	29.1	4	32	45.1	2.6855	14	52.01
	1.5	0	48	10.2	4	45	02.7	2.6769	14	54.90
	2.0	6	54	57.0	4	54	10.6	2.6670	14	58.22
	2.5	13	05	05.5	4	59	57.8	2.6561	15	01.90
	3.0	19	18	47.4	-5	02	14.6	2.6444	15	05.89
	3.5	25	36	10.1	5	00	53.3	2.6322	15	10.10
	4.0	31	57	16.7	4	55	48.2	2.6196	15	14.47
	4.5	38	22	06.2	4	46	56.5	2.6068	15	18.94
	5.0	44	50	34.4	4	34	18.2	2.5941	15	23.44
	5.5	51	22	33.7	4	17	57.1	2.5817	15	27.90
	6.0	57	57	54.5	-3	58	00.3	2.5695	15	32.28
	6.5	64	36	25.5	3	34	39.0	2.5579	15	36.53
	7.0	71	17	54.6	3	08	08.3	2.5468	15	40.60
	7.5	78	02	09.5	2	38	46.9	2.5364	15	44.48
	8.0	84	48	58.8	2	06	57.2	2.5266	15	48.13
	8.5	91	38	11.9	1	33	04.8	2.5175	15	51.55
	9.0	98	29	39.9	-0	57	37.9	2.5091	15	54.72
	9.5	105	23	15.3	-0	21	07.3	2.5015	15	57.64
	10.0	112	18	52.1	+0	15	54.6	2.4946	16	00.30
	10.5	119	16	25.5	0	52	54.1	2.4883	16	02.70
	11.0	126	15	51.2	1	29	17.0	2.4828	16	04.84
	11.5	133	17	05.1	2	04	28.7	2.4780	16	06.71
	12.0	140	20	01.9	+2	37	55.3	2.4740	16	08.28
	12.5	147	24	34.6	3	09	04.0	2.4708	16	09.54
	13.0	154	30	33.8	3	37	23.7	2.4684	16	10.46
	13.5	161	37	46.3	4	02	25.5	2.4670	16	11.01
	14.0	168	45	55.2	4	23	43.9	2.4667	16	11.15
	14.5	175	54	39.3	4	40	57.0	2.4675	16	10.84
	15.0	183	03	32.8	+4	53	47.2	2.4695	16	10.05
	15.5	190	12	05.9	5	02	02.0	2.4728	16	08.75
	16.0	197	19	45.4	5	05	34.6	2.4775	16	06.91
	16.5	204	25	55.6	5	04	23.4	2.4837	16	04.52
	17.0	211	29	59.5	+4	58	33.0	2.4912	16	01.58

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
May	17.0	211	29	59.5	+4	58	33.0	2.4912	16	01.58
	17.5	218	31	20.4	4	48	13.6	2.5003	15	58.11
	18.0	225	29	23.1	4	33	40.4	2.5107	15	54.14
	18.5	232	23	35.6	4	15	13.2	2.5223	15	49.72
	19.0	239	13	30.0	3	53	15.6	2.5351	15	44.93
	19.5	245	58	44.1	3	28	13.8	2.5489	15	39.82
	20.0	252	39	01.7	+3	00	36.0	2.5634	15	34.51
	20.5	259	14	12.9	2	30	51.2	2.5784	15	29.07
	21.0	265	44	14.9	1	59	28.3	2.5937	15	23.61
	21.5	272	09	11.2	1	26	55.8	2.6089	15	18.22
	22.0	278	29	11.6	0	53	40.7	2.6238	15	13.01
	22.5	284	44	31.7	+0	20	08.6	2.6380	15	08.08
	23.0	290	55	32.3	-0	13	17.0	2.6514	15	03.49
	23.5	297	02	38.4	0	46	14.0	2.6636	14	59.34
	24.0	303	06	19.3	1	18	22.8	2.6745	14	55.70
	24.5	309	07	06.9	1	49	24.9	2.6837	14	52.62
	25.0	315	05	35.8	2	19	03.8	2.6912	14	50.14
	25.5	321	02	22.5	2	47	04.0	2.6967	14	48.33
	26.0	326	58	04.7	-3	13	11.4	2.7001	14	47.19
	26.5	332	53	20.5	3	37	12.6	2.7015	14	46.75
	27.0	338	48	48.4	3	58	54.6	2.7007	14	47.01
	27.5	344	45	06.3	4	18	05.4	2.6977	14	47.99
	28.0	350	42	51.3	4	34	33.0	2.6927	14	49.65
	28.5	356	42	38.6	4	48	06.0	2.6856	14	51.99
	29.0	2	45	01.7	-4	58	33.1	2.6767	14	54.96
	29.5	8	50	31.2	5	05	43.9	2.6661	14	58.53
	30.0	14	59	34.5	5	09	28.3	2.6539	15	02.63
	30.5	21	12	35.5	5	09	37.5	2.6406	15	07.20
	31.0	27	29	53.6	5	06	04.0	2.6262	15	12.17
	31.5	33	51	43.3	4	58	42.2	2.6111	15	17.46
June	1.0	40	18	14.3	-4	47	28.9	2.5955	15	22.95
	1.5	46	49	30.8	4	32	23.9	2.5798	15	28.57
	2.0	53	25	31.4	4	13	30.6	2.5643	15	34.19
	2.5	60	06	09.6	3	50	56.3	2.5492	15	39.73
	3.0	66	51	13.4	3	24	52.8	2.5348	15	45.06
	3.5	73	40	26.6	2	55	36.8	2.5213	15	50.10
	4.0	80	33	28.6	-2	23	29.5	2.5090	15	54.76
	4.5	87	29	56.0	1	48	57.0	2.4981	15	58.96
	5.0	94	29	22.8	1	12	29.2	2.4885	16	02.63
	5.5	101	31	21.9	-0	34	40.0	2.4805	16	05.74
	6.0	108	35	25.6	+0	03	54.3	2.4741	16	08.26
	6.5	115	41	06.5	0	42	35.6	2.4692	16	10.18
	7.0	122	47	58.5	+1	20	45.1	2.4658	16	11.50
	7.5	129	55	36.8	1	57	44.1	2.4639	16	12.26
	8.0	137	03	38.3	2	32	55.7	2.4633	16	12.49
	8.5	144	11	42.2	3	05	44.8	2.4640	16	12.22
	9.0	151	19	29.2	+3	35	39.4	2.4658	16	11.50

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.) (X 10^{-3})	Semi Diameter	
		°	'	"	°	'	"		'	"
June	9.0	151	19	29.2	+3	35	39.4	2.4658	16	11.50
	9.5	158	26	41.8	4	02	11.3	2.4687	16	10.37
	10.0	165	33	03.8	4	24	56.3	2.4725	16	08.89
	10.5	172	38	20.0	4	43	34.4	2.4771	16	07.08
	11.0	179	42	15.7	4	57	50.4	2.4825	16	04.98
	11.5	186	44	36.5	5	07	33.9	2.4886	16	02.61
	12.0	193	45	08.2	+5	12	39.3	2.4953	16	00.00
	12.5	200	43	36.1	5	13	05.8	2.5027	15	57.16
	13.0	207	39	45.7	5	08	56.9	2.5108	15	54.10
	13.5	214	33	22.3	5	00	21.0	2.5194	15	50.82
	14.0	221	24	11.2	4	47	30.5	2.5287	15	47.34
	14.5	228	11	58.3	4	30	41.6	2.5385	15	43.66
	15.0	234	56	30.3	+4	10	13.7	2.5490	15	39.80
	15.5	241	37	35.2	3	46	29.3	2.5599	15	35.78
	16.0	248	15	02.7	3	19	53.1	2.5714	15	31.62
	16.5	254	48	44.7	2	50	51.3	2.5832	15	27.35
	17.0	261	18	35.6	2	19	51.4	2.5953	15	23.02
	17.5	267	44	32.8	1	47	21.0	2.6076	15	18.66
	18.0	274	06	36.7	+1	13	47.7	2.6200	15	14.33
	18.5	280	24	51.3	0	39	38.3	2.6322	15	10.09
	19.0	286	39	23.8	+0	05	18.8	2.6441	15	05.99
	19.5	292	50	25.1	-0	28	46.5	2.6555	15	02.11
	20.0	298	58	09.1	1	02	14.8	2.6661	14	58.50
	20.5	305	02	53.4	1	34	45.1	2.6759	14	55.24
	21.0	311	04	58.4	-2	05	58.1	2.6845	14	52.37
	21.5	317	04	47.6	2	35	36.3	2.6917	14	49.96
	22.0	323	02	46.9	3	03	23.7	2.6975	14	48.06
	22.5	328	59	24.8	3	29	05.9	2.7016	14	46.72
	23.0	334	55	11.5	3	52	29.7	2.7038	14	45.98
	23.5	340	50	39.2	4	13	23.0	2.7041	14	45.88
	24.0	346	46	21.3	-4	31	34.6	2.7024	14	46.45
	24.5	352	42	52.4	4	46	54.0	2.6986	14	47.70
	25.0	358	40	47.5	4	59	11.4	2.6927	14	49.64
	25.5	4	40	41.7	5	08	17.6	2.6847	14	52.28
	26.0	10	43	09.9	5	14	03.8	2.6748	14	55.60
	26.5	16	48	45.9	5	16	22.0	2.6629	14	59.58
	27.0	22	58	02.1	-5	15	04.9	2.6494	15	04.19
	27.5	29	11	28.8	5	10	06.2	2.6343	15	09.38
	28.0	35	29	33.3	5	01	21.1	2.6179	15	15.07
	28.5	41	52	39.4	4	48	46.7	2.6005	15	21.20
	29.0	48	21	06.3	4	32	22.2	2.5823	15	27.66
	29.5	54	55	08.3	4	12	10.1	2.5639	15	34.35
	30.0	61	34	53.7	-3	48	16.6	2.5454	15	41.14
	30.5	68	20	24.2	3	20	52.1	2.5272	15	47.89
July	1.0	75	11	34.8	2	50	11.7	2.5098	15	54.47
	1.5	82	08	13.1	2	16	36.1	2.4935	16	00.73
	2.0	89	09	59.3	-1	40	31.2	2.4785	16	06.51

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude °	'	"	Apparent Latitude °	'	"	True Geocentric Distance (A. U.) (X 10^{-3})	Semi Diameter '	"
July	1.0	75	11	34.8	-2	50	11.7	2.5098	15	54.47
	1.5	82	08	13.1	2	16	36.1	2.4935	16	00.73
	2.0	89	09	59.3	1	40	31.2	2.4785	16	06.51
	2.5	96	16	26.9	1	02	28.3	2.4653	16	11.69
	3.0	103	27	02.8	-0	23	03.5	2.4541	16	16.15
	3.5	110	41	08.0	+0	17	03.2	2.4449	16	19.79
	4.0	117	57	59.6	+0	57	08.8	2.4381	16	22.53
	4.5	125	16	51.1	1	36	29.3	2.4337	16	24.33
	5.0	132	36	54.6	2	14	20.5	2.4316	16	25.18
	5.5	139	57	22.2	2	50	00.2	2.4317	16	25.11
	6.0	147	17	27.2	3	22	49.7	2.4341	16	24.16
	6.5	154	36	25.7	3	52	14.5	2.4384	16	22.40
	7.0	161	53	37.6	+4	17	45.7	2.4446	16	19.93
	7.5	169	08	27.6	4	39	00.6	2.4523	16	16.85
	8.0	176	20	25.5	4	55	42.4	2.4614	16	13.25
	8.5	183	29	06.6	5	07	40.9	2.4715	16	09.26
	9.0	190	34	11.7	5	14	51.4	2.4825	16	04.96
	9.5	197	35	26.7	5	17	15.1	2.4942	16	00.45
	10.0	204	32	42.2	+5	14	57.5	2.5063	15	55.81
	10.5	211	25	53.1	5	08	08.7	2.5187	15	51.10
	11.0	218	14	57.7	4	57	02.3	2.5312	15	46.38
	11.5	224	59	57.4	4	41	54.9	2.5438	15	41.70
	12.0	231	40	55.7	4	23	05.8	2.5564	15	37.08
	12.5	238	17	57.9	4	00	56.1	2.5688	15	32.55
	13.0	244	51	10.7	+3	35	48.6	2.5810	15	28.13
	13.5	251	20	41.5	3	08	07.5	2.5931	15	23.82
	14.0	257	46	38.3	2	38	17.6	2.6049	15	19.64
	14.5	264	09	09.8	2	06	44.4	2.6164	15	15.59
	15.0	270	28	24.7	1	33	53.5	2.6276	15	11.68
	15.5	276	44	32.0	1	00	10.5	2.6385	15	07.93
	16.0	282	57	41.4	+0	26	00.3	2.6489	15	04.34
	16.5	289	08	02.8	-0	08	12.6	2.6589	15	00.95
	17.0	295	15	46.8	0	42	04.9	2.6683	14	57.76
	17.5	301	21	04.8	1	15	14.3	2.6771	14	54.81
	18.0	307	24	09.2	1	47	19.9	2.6852	14	52.13
	18.5	313	25	13.7	2	18	02.2	2.6923	14	49.76
	19.0	319	24	33.4	-2	47	03.3	2.6985	14	47.72
	19.5	325	22	24.7	3	14	06.9	2.7035	14	46.07
	20.0	331	19	06.1	3	38	58.2	2.7073	14	44.84
	20.5	337	14	57.5	4	01	23.8	2.7097	14	44.07
	21.0	343	10	21.0	4	21	11.7	2.7105	14	43.80
	21.5	349	05	40.2	4	38	11.4	2.7096	14	44.08
	22.0	355	01	20.9	-4	52	13.3	2.7070	14	44.94
	22.5	0	57	50.4	5	03	08.9	2.7025	14	46.40
	23.0	6	55	37.8	5	10	50.8	2.6962	14	48.49
	23.5	12	55	13.6	5	15	12.3	2.6879	14	51.24
	24.0	18	57	09.3	-5	16	07.6	2.6776	14	54.64

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
July	24.0	18	57	09.3	-5	16	07.6	2.6776	14	54.64
	24.5	25	01	57.4	5	13	31.8	2.6655	14	58.71
	25.0	31	10	10.5	5	07	20.9	2.6516	15	03.43
	25.5	37	22	21.4	4	57	32.2	2.6360	15	08.77
	26.0	43	39	01.7	4	44	04.3	2.6189	15	14.70
	26.5	50	00	41.6	4	26	57.7	2.6006	15	21.16
	27.0	56	27	48.9	-4	06	15.2	2.5812	15	28.07
	27.5	63	00	48.0	3	42	02.3	2.5611	15	35.34
	28.0	69	39	58.6	3	14	28.2	2.5407	15	42.86
	28.5	76	25	35.0	2	43	45.9	2.5203	15	50.48
	29.0	83	17	44.5	2	10	13.4	2.5004	15	58.07
	29.5	90	16	26.6	1	34	13.7	2.4813	16	05.44
	30.0	97	21	31.8	-0	56	15.3	2.4635	16	12.42
	30.5	104	32	40.9	-0	16	52.2	2.4473	16	18.84
	31.0	111	49	24.7	+0	23	16.5	2.4332	16	24.51
	31.5	119	11	03.9	1	03	27.7	2.4215	16	29.27
Aug.	1.0	126	36	49.8	1	42	55.1	2.4125	16	32.98
	1.5	134	05	45.4	2	20	51.5	2.4062	16	35.55
	2.0	141	36	47.4	+2	56	30.3	2.4030	16	36.91
	2.5	149	08	48.2	3	29	07.9	2.4027	16	37.03
	3.0	156	40	38.6	3	58	05.4	2.4053	16	35.95
	3.5	164	11	10.6	4	22	50.2	2.4107	16	33.72
	4.0	171	39	20.0	4	42	57.2	2.4186	16	30.46
	4.5	179	04	09.0	4	58	09.5	2.4288	16	26.30
	5.0	186	24	47.5	+5	08	18.2	2.4410	16	21.37
	5.5	193	40	35.0	5	13	22.2	2.4548	16	15.85
	6.0	200	51	00.8	5	13	27.1	2.4699	16	09.88
	6.5	207	55	44.3	5	08	44.1	2.4859	16	03.63
	7.0	214	54	34.0	4	59	29.3	2.5026	15	57.22
	7.5	221	47	27.4	4	46	02.3	2.5195	15	50.79
	8.0	228	34	29.2	+4	28	44.9	2.5365	15	44.44
	8.5	235	15	50.2	4	08	00.9	2.5532	15	38.25
	9.0	241	51	46.1	3	44	14.8	2.5695	15	32.29
	9.5	248	22	36.2	3	17	51.8	2.5853	15	26.61
	10.0	254	48	42.2	2	49	16.8	2.6003	15	21.25
	10.5	261	10	27.1	2	18	55.0	2.6146	15	16.23
	11.0	267	28	14.6	+1	47	10.7	2.6279	15	11.56
	11.5	273	42	28.0	1	14	28.1	2.6404	15	07.25
	12.0	279	53	30.2	0	41	10.6	2.6520	15	03.29
	12.5	286	01	43.0	+0	07	41.0	2.6626	14	59.68
	13.0	292	07	26.6	-0	25	38.7	2.6723	14	56.42
	13.5	298	11	00.3	0	58	27.2	2.6811	14	53.49
	14.0	304	12	41.7	-1	30	24.1	2.6889	14	50.89
	14.5	310	12	47.1	2	01	10.0	2.6958	14	48.62
	15.0	316	11	31.7	2	30	26.5	2.7017	14	46.67
	15.5	322	09	09.8	2	57	56.5	2.7066	14	45.06
	16.0	328	05	55.2	-3	23	24.2	2.7105	14	43.78

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Aug.	16.0	328	05	55.2	-3	23	24.2	2.7105	14	43.78
	16.5	334	02	01.3	3	46	34.9	2.7134	14	42.86
	17.0	339	57	41.6	4	07	15.5	2.7151	14	42.31
	17.5	345	53	10.1	4	25	14.2	2.7156	14	42.14
	18.0	351	48	41.4	4	40	20.8	2.7148	14	42.40
	18.5	357	44	31.5	4	52	26.2	2.7127	14	43.09
	19.0	3	40	57.5	-5	01	23.2	2.7091	14	44.25
	19.5	9	38	18.3	5	07	05.4	2.7041	14	45.90
	20.0	15	36	54.4	5	09	28.0	2.6974	14	48.08
	20.5	21	37	08.4	5	08	27.5	2.6892	14	50.80
	21.0	27	39	24.8	5	04	01.4	2.6793	14	54.09
	21.5	33	44	09.8	4	56	08.7	2.6677	14	57.96
	22.0	39	51	51.7	-4	44	49.5	2.6545	15	02.42
	22.5	46	02	59.8	4	30	05.5	2.6398	15	07.47
	23.0	52	18	04.8	4	11	59.9	2.6235	15	13.10
	23.5	58	37	37.5	3	50	37.7	2.6059	15	19.26
	24.0	65	02	08.9	3	26	06.1	2.5871	15	25.93
	24.5	71	32	08.5	2	58	35.0	2.5674	15	33.04
	25.0	78	08	03.8	-2	28	17.2	2.5471	15	40.50
	25.5	84	50	18.8	1	55	29.3	2.5264	15	48.20
	26.0	91	39	12.7	1	20	31.7	2.5057	15	56.02
	26.5	98	34	58.0	0	43	49.5	2.4855	16	03.81
	27.0	105	37	39.3	-0	05	52.4	2.4661	16	11.40
	27.5	112	47	11.6	+0	32	44.9	2.4479	16	18.59
	28.0	120	03	18.7	+1	11	23.5	2.4315	16	25.20
	28.5	127	25	32.1	1	49	20.5	2.4172	16	31.03
	29.0	134	53	10.9	2	25	50.8	2.4054	16	35.90
	29.5	142	25	21.8	3	00	08.3	2.3964	16	39.64
	30.0	150	00	59.7	3	31	27.9	2.3905	16	42.12
	30.5	157	38	50.8	3	59	08.1	2.3878	16	43.26
	31.0	165	17	34.2	+4	22	32.8	2.3883	16	43.02
	31.5	172	55	46.4	4	41	13.2	2.3922	16	41.41
Sept.	1.0	180	32	04.5	4	54	49.1	2.3991	16	38.51
	1.5	188	05	10.4	5	03	09.7	2.4090	16	34.42
	2.0	195	33	53.8	5	06	13.2	2.4214	16	29.30
	2.5	202	57	15.2	5	04	06.6	2.4362	16	23.31
	3.0	210	14	27.4	+4	57	04.1	2.4528	16	16.64
	3.5	217	24	56.5	4	45	25.8	2.4709	16	09.50
	4.0	224	28	22.0	4	29	36.1	2.4900	16	02.05
	4.5	231	24	35.5	4	10	02.4	2.5098	15	54.49
	5.0	238	13	39.8	3	47	13.1	2.5297	15	46.94
	5.5	244	55	47.2	3	21	37.5	2.5496	15	39.56
	6.0	251	31	17.5	+2	53	44.3	2.5691	15	32.46
	6.5	258	00	36.4	2	24	01.2	2.5878	15	25.70
	7.0	264	24	13.8	1	52	54.8	2.6056	15	19.38
	7.5	270	42	42.4	1	20	50.3	2.6223	15	13.53
	8.0	276	56	36.2	+0	48	11.5	2.6377	15	08.18

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Sept.	8.0	276	56	36.2	+0	48	11.5	2.6377	15	08.18
	8.5	283	06	29.5	+0	15	20.6	2.6518	15	03.36
	9.0	289	12	56.1	-0	17	21.0	2.6645	14	59.06
	9.5	295	16	28.6	0	49	33.3	2.6757	14	55.28
	10.0	301	17	37.8	1	20	57.5	2.6855	14	52.02
	10.5	307	16	52.2	1	51	15.4	2.6939	14	49.25
	11.0	313	14	38.1	-2	20	10.0	2.7008	14	46.95
	11.5	319	11	19.2	2	47	24.8	2.7065	14	45.11
	12.0	325	07	16.6	3	12	44.5	2.7108	14	43.70
	12.5	331	02	49.2	3	35	54.8	2.7139	14	42.70
	13.0	336	58	13.4	3	56	42.0	2.7157	14	42.09
	13.5	342	53	43.6	4	14	54.1	2.7165	14	41.86
	14.0	348	49	32.9	-4	30	19.8	2.7160	14	41.99
	14.5	354	45	52.5	4	42	49.5	2.7145	14	42.48
	15.0	0	42	53.4	4	52	14.8	2.7119	14	43.33
	15.5	6	40	45.6	4	58	29.0	2.7082	14	44.54
	16.0	12	39	39.8	5	01	27.0	2.7034	14	46.11
	16.5	18	39	46.7	5	01	05.3	2.6975	14	48.06
	17.0	24	41	18.5	-4	57	21.9	2.6904	14	50.40
	17.5	30	44	28.5	4	50	16.8	2.6822	14	53.13
	18.0	36	49	31.9	4	39	51.5	2.6727	14	56.29
	18.5	42	56	45.7	4	26	09.3	2.6620	14	59.88
	19.0	49	06	29.5	4	09	15.2	2.6501	15	03.92
	19.5	55	19	04.5	3	49	16.0	2.6370	15	08.41
	20.0	61	34	54.4	-3	26	20.3	2.6227	15	13.36
	20.5	67	54	24.6	3	00	38.8	2.6073	15	18.76
	21.0	74	18	01.9	2	32	24.1	2.5909	15	24.60
	21.5	80	46	13.6	2	01	51.4	2.5735	15	30.83
	22.0	87	19	27.3	1	29	18.5	2.5555	15	37.41
	22.5	93	58	09.2	0	55	06.0	2.5369	15	44.28
	23.0	100	42	43.2	-0	19	37.7	2.5180	15	51.35
	23.5	107	33	29.0	+0	16	39.3	2.4992	15	58.51
	24.0	114	30	41.0	0	53	14.3	2.4808	16	05.63
	24.5	121	34	25.9	1	29	33.1	2.4631	16	12.57
	25.0	128	44	41.4	2	04	58.7	2.4465	16	19.15
	25.5	136	01	14.1	2	38	51.5	2.4315	16	25.21
	26.0	143	23	38.3	+3	10	30.7	2.4184	16	30.55
	26.5	150	51	15.4	3	39	15.3	2.4076	16	35.00
	27.0	158	23	13.6	4	04	26.2	2.3994	16	38.40
	27.5	165	58	28.8	4	25	28.2	2.3941	16	40.62
	28.0	173	35	47.0	4	41	51.4	2.3918	16	41.55
	28.5	181	13	46.5	4	53	13.6	2.3928	16	41.15
	29.0	188	51	02.1	+4	59	21.0	2.3970	16	39.41
	29.5	196	26	08.8	5	00	09.2	2.4042	16	36.37
	30.0	203	57	46.2	4	55	43.2	2.4145	16	32.15
	30.5	211	24	42.1	4	46	16.5	2.4274	16	26.86
Oct.	1.0	218	45	55.0	+4	32	09.9	2.4427	16	20.67

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Oct.	1.0	218	45	55.0	+4	32	09.9	2.4427	16	20.67
	1.5	226	00	36.8	4	13	50.0	2.4600	16	13.78
	2.0	233	08	13.1	3	51	47.5	2.4789	16	06.37
	2.5	240	08	23.8	3	26	34.9	2.4989	15	58.63
	3.0	247	01	01.6	2	58	46.0	2.5196	15	50.76
	3.5	253	46	11.1	2	28	53.5	2.5405	15	42.92
	4.0	260	24	07.1	+1	57	29.3	2.5614	15	35.25
	4.5	266	55	12.6	1	25	02.8	2.5817	15	27.89
	5.0	273	19	56.9	0	52	01.7	2.6012	15	20.93
	5.5	279	38	54.1	+0	18	50.8	2.6196	15	14.47
	6.0	285	52	41.3	-0	14	06.8	2.6366	15	08.56
	6.5	292	01	57.4	0	46	30.3	2.6521	15	03.24
	7.0	298	07	22.0	-1	18	00.9	2.6660	14	58.55
	7.5	304	09	34.2	1	48	21.0	2.6781	14	54.49
	8.0	310	09	12.0	2	17	14.6	2.6884	14	51.08
	8.5	316	06	51.8	2	44	26.8	2.6968	14	48.29
	9.0	322	03	07.8	3	09	43.4	2.7034	14	46.11
	9.5	327	58	31.3	3	32	51.4	2.7083	14	44.51
	10.0	333	53	31.2	-3	53	38.3	2.7115	14	43.47
	10.5	339	48	33.1	4	11	52.6	2.7131	14	42.96
	11.0	345	43	59.5	4	27	23.5	2.7131	14	42.94
	11.5	351	40	10.1	4	40	01.2	2.7118	14	43.38
	12.0	357	37	21.3	4	49	37.0	2.7092	14	44.23
	12.5	3	35	47.1	4	56	03.4	2.7054	14	45.47
	13.0	9	35	38.6	-4	59	14.2	2.7005	14	47.06
	13.5	15	37	05.2	4	59	05.2	2.6947	14	48.98
	14.0	21	40	14.5	4	55	33.6	2.6880	14	51.20
	14.5	27	45	12.7	4	48	38.7	2.6805	14	53.70
	15.0	33	52	05.8	4	38	21.8	2.6722	14	56.47
	15.5	40	00	59.3	4	24	46.6	2.6632	14	59.49
	16.0	46	11	59.4	-4	07	58.7	2.6536	15	02.76
	16.5	52	25	13.1	3	48	06.3	2.6433	15	06.27
	17.0	58	40	49.1	3	25	19.7	2.6324	15	10.03
	17.5	64	58	57.5	2	59	51.3	2.6208	15	14.04
	18.0	71	19	50.5	2	31	56.0	2.6087	15	18.30
	18.5	77	43	42.4	2	01	50.7	2.5959	15	22.80
	19.0	84	10	49.2	-1	29	54.5	2.5826	15	27.55
	19.5	90	41	28.8	0	56	28.5	2.5689	15	32.53
	20.0	97	16	00.1	-0	21	56.1	2.5546	15	37.72
	20.5	103	54	42.4	+0	13	17.3	2.5401	15	43.09
	21.0	110	37	54.5	0	48	44.3	2.5253	15	48.61
	21.5	117	25	53.6	1	23	55.4	2.5105	15	54.20
	22.0	124	18	54.1	+1	58	19.2	2.4958	15	59.81
	22.5	131	17	05.5	2	31	22.8	2.4816	16	05.33
	23.0	138	20	31.8	3	02	32.1	2.4679	16	10.66
	23.5	145	29	08.9	3	31	12.6	2.4552	16	15.68
	24.0	152	42	44.2	+3	56	50.0	2.4438	16	20.25

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude °	'	"	Apparent Latitude °	'	"	True Geocentric Distance (A. U.) (X 10^{-3})	Semi Diameter '	"
Oct.	24.0	152	42	44.2	+3	56	50.0	2.4438	16	20.25
	24.5	160	00	54.6	4	18	51.5	2.4339	16	24.25
	25.0	167	23	06.5	4	36	47.1	2.4258	16	27.52
	25.5	174	48	35.4	4	50	10.9	2.4198	16	29.95
	26.0	182	16	27.1	4	58	42.6	2.4163	16	31.42
	26.5	189	45	38.7	5	02	08.9	2.4152	16	31.84
	27.0	197	15	01.4	+5	00	24.0	2.4169	16	31.16
	27.5	204	43	23.2	4	53	30.7	2.4213	16	29.36
	28.0	212	09	32.2	4	41	40.0	2.4284	16	26.47
	28.5	219	32	19.9	4	25	10.5	2.4381	16	22.54
	29.0	226	50	44.3	4	04	27.4	2.4503	16	17.66
	29.5	234	03	52.1	3	40	01.1	2.4646	16	11.98
	30.0	241	11	00.9	+3	12	25.6	2.4808	16	05.63
	30.5	248	11	39.7	2	42	16.5	2.4985	15	58.79
	31.0	255	05	29.5	2	10	10.1	2.5173	15	51.61
	31.5	261	52	22.8	1	36	41.4	2.5369	15	44.27
Nov.	1.0	268	32	22.4	1	02	23.7	2.5568	15	36.94
	1.5	275	05	40.8	+0	27	47.9	2.5766	15	29.74
	2.0	281	32	37.9	-0	06	38.2	2.5959	15	22.82
	2.5	287	53	40.5	0	40	29.5	2.6144	15	16.29
	3.0	294	09	20.0	1	13	23.9	2.6318	15	10.24
	3.5	300	20	11.8	1	45	02.0	2.6477	15	04.75
	4.0	306	26	53.5	2	15	06.4	2.6621	14	59.87
	4.5	312	30	04.4	2	43	22.0	2.6746	14	55.65
	5.0	318	30	24.2	-3	09	35.2	2.6852	14	52.11
	5.5	324	28	32.2	3	33	33.9	2.6938	14	49.27
	6.0	330	25	07.1	3	55	06.7	2.7003	14	47.12
	6.5	336	20	45.8	4	14	03.7	2.7048	14	45.67
	7.0	342	16	03.6	4	30	15.2	2.7071	14	44.89
	7.5	348	11	33.0	4	43	32.5	2.7076	14	44.75
	8.0	354	07	44.3	-4	53	47.6	2.7061	14	45.22
	8.5	0	05	04.6	5	00	53.3	2.7029	14	46.27
	9.0	6	03	57.6	5	04	43.3	2.6982	14	47.83
	9.5	12	04	44.2	5	05	12.3	2.6920	14	49.88
	10.0	18	07	41.5	5	02	16.4	2.6845	14	52.34
	10.5	24	13	03.6	4	55	53.5	2.6760	14	55.18
	11.0	30	21	01.0	-4	46	03.2	2.6667	14	58.33
	11.5	36	31	41.7	4	32	47.3	2.6566	15	01.73
	12.0	42	45	10.7	4	16	10.2	2.6460	15	05.34
	12.5	49	01	30.8	3	56	18.8	2.6350	15	09.11
	13.0	55	20	42.9	3	33	23.0	2.6238	15	12.99
	13.5	61	42	46.9	3	07	35.4	2.6125	15	16.94
	14.0	68	07	41.7	-2	39	11.6	2.6012	15	20.93
	14.5	74	35	26.0	2	08	30.3	2.5900	15	24.92
	15.0	81	05	58.9	1	35	52.5	2.5789	15	28.90
	15.5	87	39	20.2	1	01	42.0	2.5680	15	32.85
	16.0	94	15	30.5	-0	26	24.7	2.5572	15	36.76

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Nov.	16.0	94	15	30.5	-0	26	24.7	2.5572	15	36.76
	16.5	100	54	31.7	+0	09	31.7	2.5468	15	40.62
	17.0	107	36	26.7	0	45	37.8	2.5365	15	44.42
	17.5	114	21	19.1	1	21	23.1	2.5265	15	48.16
	18.0	121	09	13.4	1	56	16.6	2.5168	15	51.83
	18.5	128	00	13.6	2	29	46.6	2.5073	15	55.41
	19.0	134	54	23.1	+3	01	21.6	2.4983	15	58.88
	19.5	141	51	43.7	3	30	30.7	2.4896	16	02.21
	20.0	148	52	14.3	3	56	44.1	2.4815	16	05.36
	20.5	155	55	50.3	4	19	33.6	2.4740	16	08.28
	21.0	163	02	22.7	4	38	33.2	2.4673	16	10.91
	21.5	170	11	36.9	4	53	20.2	2.4616	16	13.18
	22.0	177	23	12.5	+5	03	35.7	2.4569	16	15.01
	22.5	184	36	42.9	5	09	05.2	2.4536	16	16.34
	23.0	191	51	35.3	5	09	39.9	2.4517	16	17.09
	23.5	199	07	11.3	5	05	16.7	2.4515	16	17.18
	24.0	206	22	48.1	4	55	59.3	2.4530	16	16.57
	24.5	213	37	39.3	4	41	57.7	2.4564	16	15.21
	25.0	220	50	57.0	+4	23	28.3	2.4618	16	13.08
	25.5	228	01	53.5	4	00	53.7	2.4691	16	10.19
	26.0	235	09	43.2	3	34	41.2	2.4784	16	06.57
	26.5	242	13	44.1	3	05	22.5	2.4894	16	02.27
	27.0	249	13	19.9	2	33	31.8	2.5022	15	57.37
	27.5	256	08	00.6	1	59	44.9	2.5164	15	51.97
	28.0	262	57	23.5	+1	24	37.5	2.5318	15	46.17
	28.5	269	41	14.1	0	48	44.8	2.5481	15	40.11
	29.0	276	19	25.3	+0	12	39.9	2.5651	15	33.90
	29.5	282	51	57.8	-0	23	06.6	2.5823	15	27.68
	30.0	289	18	59.4	0	58	06.9	2.5994	15	21.57
	30.5	295	40	44.1	1	31	56.5	2.6161	15	15.68
Dec.	1.0	301	57	31.9	-2	04	13.7	2.6321	15	10.12
	1.5	308	09	47.2	2	34	40.0	2.6470	15	04.98
	2.0	314	17	58.6	3	02	59.3	2.6607	15	00.35
	2.5	320	22	37.7	3	28	58.2	2.6727	14	56.29
	3.0	326	24	18.8	3	52	24.9	2.6830	14	52.87
	3.5	332	23	37.4	4	13	09.6	2.6913	14	50.11
	4.0	338	21	10.6	-4	31	03.5	2.6975	14	48.06
	4.5	344	17	35.4	4	45	59.2	2.7016	14	46.72
	5.0	350	13	29.1	4	57	50.0	2.7034	14	46.11
	5.5	356	09	28.2	5	06	29.9	2.7031	14	46.22
	6.0	2	06	08.0	5	11	53.6	2.7006	14	47.03
	6.5	8	04	02.5	5	13	56.7	2.6961	14	48.53
	7.0	14	03	43.4	-5	12	35.2	2.6896	14	50.67
	7.5	20	05	40.2	5	07	46.4	2.6813	14	53.42
	8.0	26	10	19.4	4	59	28.6	2.6715	14	56.71
	8.5	32	18	04.4	4	47	41.6	2.6603	15	00.48
	9.0	38	29	15.1	-4	32	27.2	2.6479	15	04.68

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Longitude			Apparent Latitude			True Geocentric Distance (A. U.)	Semi Diameter	
		°	'	"	°	'	"	(X 10^{-3})	'	"
Dec.	9.0	38	29	15.1	-4	32	27.2	2.6479	15	04.68
	9.5	44	44	07.6	4	13	49.2	2.6347	15	09.21
	10.0	51	02	53.8	3	51	54.1	2.6210	15	13.99
	10.5	57	25	41.9	3	26	51.5	2.6068	15	18.94
	11.0	63	52	35.5	2	58	54.1	2.5926	15	23.97
	11.5	70	23	34.3	2	28	18.4	2.5786	15	28.99
	12.0	76	58	34.4	-1	55	24.3	2.5650	15	33.92
	12.5	83	37	28.1	1	20	35.6	2.5520	15	38.67
	13.0	90	20	04.6	0	44	19.1	2.5399	15	43.17
	13.5	97	06	10.6	-0	07	05.1	2.5286	15	47.37
	14.0	103	55	30.6	+0	30	34.0	2.5184	15	51.21
	14.5	110	47	47.8	1	08	03.9	2.5093	15	54.66
	15.0	117	42	44.1	+1	44	49.0	2.5014	15	57.69
	15.5	124	40	01.3	2	20	13.9	2.4945	16	00.31
	16.0	131	39	21.1	2	53	43.8	2.4889	16	02.50
	16.5	138	40	25.3	3	24	45.2	2.4842	16	04.29
	17.0	145	42	56.5	3	52	47.3	2.4806	16	05.69
	17.5	152	46	37.6	4	17	22.0	2.4780	16	06.73
	18.0	159	51	12.3	+4	38	04.6	2.4762	16	07.42
	18.5	166	56	24.4	4	54	34.7	2.4753	16	07.79
	19.0	174	01	58.3	5	06	36.2	2.4751	16	07.85
	19.5	181	07	38.1	5	13	57.3	2.4757	16	07.61
	20.0	188	13	07.5	5	16	31.5	2.4771	16	07.09
	20.5	195	18	09.9	5	14	16.9	2.4792	16	06.26
	21.0	202	22	27.8	+5	07	16.7	2.4821	16	05.13
	21.5	209	25	42.8	4	55	38.9	2.4858	16	03.67
	22.0	216	27	35.8	4	39	36.5	2.4905	16	01.88
	22.5	223	27	46.9	4	19	27.0	2.4960	15	59.74
	23.0	230	25	55.7	3	55	31.8	2.5026	15	57.23
	23.5	237	21	41.7	3	28	16.4	2.5101	15	54.34
	24.0	244	14	44.9	+2	58	09.1	2.5187	15	51.09
	24.5	251	04	46.0	2	25	40.7	2.5283	15	47.47
	25.0	257	51	27.1	1	51	23.4	2.5390	15	43.51
	25.5	264	34	32.6	1	15	50.3	2.5505	15	39.25
	26.0	271	13	49.1	0	39	34.3	2.5628	15	34.73
	26.5	277	49	06.3	+0	03	07.6	2.5758	15	30.02
	27.0	284	20	17.6	-0	32	59.3	2.5893	15	25.18
	27.5	290	47	19.7	1	08	17.9	2.6030	15	20.29
	28.0	297	10	13.7	1	42	22.4	2.6168	15	15.43
	28.5	303	29	04.3	2	14	49.4	2.6305	15	10.68
	29.0	309	44	00.5	2	45	18.7	2.6437	15	06.13
	29.5	315	55	15.1	3	13	32.8	2.6562	15	01.87
	30.0	322	03	04.8	-3	39	16.8	2.6677	14	57.97
	30.5	328	07	49.8	4	02	18.5	2.6781	14	54.50
	31.0	334	09	53.3	4	22	27.7	2.6870	14	51.54
	31.5	340	09	41.7	4	39	36.2	2.6942	14	49.14
	32.0	346	07	43.9	-4	53	37.5	2.6996	14	47.35

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Jan.	0.0	13	56	10.34	-6	16	03.01	57	15.94
	0.5	14	21	02.99	8	32	42.46	56	57.00
	1.0	14	45	57.96	10	42	05.26	56	38.91
	1.5	15	10	59.32	12	42	51.70	56	21.75
	2.0	15	36	10.17	14	33	46.62	56	05.53
	2.5	16	01	32.50	16	13	39.78	55	50.25
	3.0	16	27	07.14	-17	41	26.64	55	35.91
	3.5	16	52	53.66	18	56	09.66	55	22.48
	4.0	17	18	50.39	19	56	59.84	55	09.95
	4.5	17	44	54.55	20	43	18.48	54	58.30
	5.0	18	11	02.40	21	14	38.70	54	47.55
	5.5	18	37	09.51	21	30	46.65	54	37.71
	6.0	19	03	11.11	-21	31	42.19	54	28.82
	6.5	19	29	02.41	21	17	38.74	54	20.93
	7.0	19	54	39.00	20	49	02.48	54	14.11
	7.5	20	19	57.15	20	06	30.90	54	08.46
	8.0	20	44	54.03	19	10	50.77	54	04.09
	8.5	21	09	27.87	18	02	55.98	54	01.12
	9.0	21	33	38.05	-16	43	45.24	53	59.67
	9.5	21	57	25.05	15	14	20.10	53	59.90
	10.0	22	20	50.41	13	35	43.22	54	01.92
	10.5	22	43	56.63	11	48	57.10	54	05.89
	11.0	23	06	47.07	9	55	03.36	54	11.92
	11.5	23	29	25.80	7	55	02.44	54	20.13
	12.0	23	51	57.55	-5	49	53.83	54	30.62
	12.5	0	14	27.57	3	40	36.69	54	43.46
	13.0	0	37	01.58	-1	28	10.88	54	58.67
	13.5	0	59	45.70	+0	46	21.65	55	16.27
	14.0	1	22	46.37	3	01	55.24	55	36.21
	14.5	1	46	10.29	5	17	18.56	55	58.39
	15.0	2	10	04.26	+7	31	12.60	56	22.63
	15.5	2	34	35.06	9	42	08.66	56	48.72
	16.0	2	59	49.22	11	48	26.51	57	16.32
	16.5	3	25	52.67	13	48	13.10	57	45.06
	17.0	3	52	50.32	15	39	22.28	58	14.44
	17.5	4	20	45.53	17	19	35.91	58	43.91
	18.0	4	49	39.52	+18	46	27.11	59	12.81
	18.5	5	19	30.74	19	57	25.97	59	40.45
	19.0	5	50	14.38	20	50	07.90	60	06.09
	19.5	6	21	42.21	21	22	24.33	60	29.00
	20.0	6	53	42.81	21	32	34.43	60	48.47
	20.5	7	26	02.25	21	19	36.14	61	03.87
	21.0	7	58	25.41	+20	43	14.35	61	14.71
	21.5	8	30	37.32	19	44	04.41	61	20.64
	22.0	9	02	24.63	18	23	30.09	61	21.50
	22.5	9	33	36.70	16	43	36.70	61	17.31
	23.0	10	04	06.21	+14	47	00.51	61	08.31

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension h	m	s	Apparent Declination °	'	"	Horizontal Parallax '	"
Jan.	23.0	10	04	06.21	+14	47	00.51	61	08.31
	23.5	10	33	49.22	12	36	37.00	60	54.88
	24.0	11	02	44.94	10	15	29.38	60	37.56
	24.5	11	30	55.12	7	46	39.20	60	16.97
	25.0	11	58	23.49	5	12	59.29	59	53.80
	25.5	12	25	15.08	2	37	09.40	59	28.74
	26.0	12	51	35.73	+0	01	34.06	59	02.47
	26.5	13	17	31.62	-2	31	37.79	58	35.62
	27.0	13	43	08.96	5	00	31.98	58	08.75
	27.5	14	08	33.65	7	23	27.59	57	42.33
	28.0	14	33	51.17	9	38	55.21	57	16.77
	28.5	14	59	06.30	11	45	35.15	56	52.37
	29.0	15	24	23.04	-13	42	16.05	56	29.38
	29.5	15	49	44.49	15	27	53.75	56	07.97
	30.0	16	15	12.69	17	01	30.83	55	48.23
	30.5	16	40	48.60	18	22	16.52	55	30.22
	31.0	17	06	32.09	19	29	27.20	55	13.96
	31.5	17	32	21.90	20	22	27.13	54	59.43
Feb.	1.0	17	58	15.79	-21	00	49.49	54	46.57
	1.5	18	24	10.70	21	24	17.44	54	35.33
	2.0	18	50	02.97	21	32	44.94	54	25.63
	2.5	19	15	48.62	21	26	17.32	54	17.42
	3.0	19	41	23.67	21	05	11.32	54	10.61
	3.5	20	06	44.41	20	29	54.64	54	05.15
	4.0	20	31	47.69	-19	41	04.99	54	00.99
	4.5	20	56	31.11	18	39	28.72	53	58.10
	5.0	21	20	53.18	17	25	59.26	53	56.46
	5.5	21	44	53.35	16	01	35.34	53	56.09
	6.0	22	08	32.04	14	27	19.43	53	57.01
	6.5	22	31	50.61	12	44	16.21	53	59.26
	7.0	22	54	51.26	-10	53	31.44	54	02.89
	7.5	23	17	36.94	8	56	11.07	54	07.98
	8.0	23	40	11.31	6	53	20.79	54	14.61
	8.5	0	02	38.57	4	46	05.87	54	22.88
	9.0	0	25	03.46	2	35	31.39	54	32.87
	9.5	0	47	31.13	-0	22	42.80	54	44.66
	10.0	1	10	07.12	+1	51	13.25	54	58.33
	10.5	1	32	57.26	4	05	07.80	55	13.94
	11.0	1	56	07.60	6	17	48.27	55	31.51
	11.5	2	19	44.34	8	27	56.92	55	51.04
	12.0	2	43	53.66	10	34	09.43	56	12.47
	12.5	3	08	41.52	12	34	53.41	56	35.71
	13.0	3	34	13.47	+14	28	27.34	57	00.59
	13.5	4	00	34.23	16	13	00.12	57	26.88
	14.0	4	27	47.30	17	46	31.60	57	54.25
	14.5	4	55	54.51	19	06	54.52	58	22.31
	15.0	5	24	55.44	+20	11	58.37	58	50.57

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension h	m	s	Apparent Declination °	'	"	Horizontal Parallax '	"
Feb.	15.0	5	24	55.44	+20	11	58.37	58	50.57
	15.5	5	54	47.10	20	59	35.22	59	18.46
	16.0	6	25	23.57	21	27	47.61	59	45.33
	16.5	6	56	36.18	21	34	57.85	60	10.50
	17.0	7	28	13.87	21	19	57.66	60	33.22
	17.5	8	00	04.05	20	42	16.54	60	52.78
	18.0	8	31	53.71	+19	42	07.55	61	08.51
	18.5	9	03	30.62	18	20	29.00	61	19.83
	19.0	9	34	44.32	16	39	01.93	61	26.29
	19.5	10	05	26.90	14	40	03.81	61	27.63
	20.0	10	35	33.27	12	26	19.56	61	23.75
	20.5	11	05	01.13	10	00	51.40	61	14.78
	21.0	11	33	50.61	+7	26	49.01	61	01.04
	21.5	12	02	03.84	4	47	20.84	60	43.00
	22.0	12	29	44.36	+2	05	27.30	60	21.28
	22.5	12	56	56.67	-0	36	04.00	59	56.58
	23.0	13	23	45.71	3	14	41.06	59	29.63
	23.5	13	50	16.56	5	48	08.77	59	01.18
	24.0	14	16	34.09	-8	14	28.80	58	31.94
	24.5	14	42	42.75	10	31	58.83	58	02.57
	25.0	15	08	46.36	12	39	11.28	57	33.65
	25.5	15	34	48.01	14	34	51.82	57	05.66
	26.0	16	00	49.89	16	17	58.19	56	39.03
	26.5	16	26	53.26	17	47	39.05	56	14.06
	27.0	16	52	58.42	-19	03	13.29	55	51.00
	27.5	17	19	04.77	20	04	09.61	55	30.02
	28.0	17	45	10.80	20	50	06.37	55	11.23
	28.5	18	11	14.33	21	20	51.53	54	54.67
Mar.	1.0	18	37	12.63	21	36	22.76	54	40.36
	1.5	19	03	02.67	21	36	47.31	54	28.25
	2.0	19	28	41.35	-21	22	21.86	54	18.30
	2.5	19	54	05.76	20	53	32.04	54	10.41
	3.0	20	19	13.37	20	10	51.80	54	04.49
	3.5	20	44	02.21	19	15	02.49	54	00.42
	4.0	21	08	31.03	18	06	51.92	53	58.08
	4.5	21	32	39.33	16	47	13.25	53	57.38
	5.0	21	56	27.39	-15	17	04.01	53	58.19
	5.5	22	19	56.27	13	37	25.09	54	00.41
	6.0	22	43	07.76	11	49	20.00	54	03.95
	6.5	23	06	04.32	9	53	54.18	54	08.75
	7.0	23	28	48.97	7	52	14.57	54	14.74
	7.5	23	51	25.27	5	45	29.35	54	21.88
	8.0	0	13	57.22	-3	34	47.89	54	30.16
	8.5	0	36	29.20	-1	21	20.83	54	39.56
	9.0	0	59	05.89	+0	53	39.59	54	50.10
	9.5	1	21	52.26	3	08	59.14	55	01.81
	10.0	1	44	53.43	+5	23	20.95	55	14.71

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Mar.	10.0	1	44	53.43	+5	23	20.95	55	14.71
	10.5	2	08	14.65	7	35	24.91	55	28.83
	11.0	2	32	01.13	9	43	46.85	55	44.20
	11.5	2	56	17.97	11	46	57.94	56	00.86
	12.0	3	21	09.95	13	43	24.09	56	18.78
	12.5	3	46	41.26	15	31	25.76	56	37.95
	13.0	4	12	55.28	+17	09	18.27	56	58.31
	13.5	4	39	54.21	18	35	12.85	57	19.75
	14.0	5	07	38.75	19	47	18.75	57	42.09
	14.5	5	36	07.78	20	43	46.53	58	05.13
	15.0	6	05	18.11	21	22	52.57	58	28.56
	15.5	6	35	04.46	21	43	04.74	58	52.03
	16.0	7	05	19.56	+21	43	08.74	59	15.10
	16.5	7	35	54.62	21	22	14.46	59	37.28
	17.0	8	06	39.94	20	40	01.46	59	58.01
	17.5	8	37	25.74	19	36	42.89	60	16.71
	18.0	9	08	02.90	18	13	07.01	60	32.80
	18.5	9	38	23.74	16	30	36.35	60	45.69
	19.0	10	08	22.45	+14	31	04.47	60	54.89
	19.5	10	37	55.35	12	16	50.96	60	59.98
	20.0	11	07	00.82	9	50	35.20	61	00.65
	20.5	11	35	39.11	7	15	09.72	60	56.78
	21.0	12	03	51.98	4	33	33.53	60	48.39
	21.5	12	31	42.33	+1	48	46.06	60	35.67
	22.0	12	59	13.76	-0	56	18.17	60	18.96
	22.5	13	26	30.20	3	38	53.78	59	58.74
	23.0	13	53	35.59	6	16	27.84	59	35.60
	23.5	14	20	33.58	8	46	42.08	59	10.16
	24.0	14	47	27.31	11	07	34.21	58	43.12
	24.5	15	14	19.17	13	17	18.62	58	15.13
	25.0	15	41	10.75	-15	14	26.39	57	46.84
	25.5	16	08	02.69	16	57	45.08	57	18.83
	26.0	16	34	54.66	18	26	18.16	56	51.62
	26.5	17	01	45.45	19	39	24.42	56	25.68
	27.0	17	28	33.04	20	36	37.19	56	01.36
	27.5	17	55	14.78	21	17	43.48	55	38.97
	28.0	18	21	47.62	-21	42	43.03	55	18.75
	28.5	18	48	08.34	21	51	47.17	55	00.84
	29.0	19	14	13.82	21	45	17.56	54	45.37
	29.5	19	40	01.26	21	23	44.84	54	32.39
	30.0	20	05	28.41	20	47	47.15	54	21.90
	30.5	20	30	33.67	19	58	08.78	54	13.88
	31.0	20	55	16.23	-18	55	38.84	54	08.27
	31.5	21	19	36.05	17	41	10.13	54	04.97
Apr.	1.0	21	43	33.90	16	15	38.26	54	03.87
	1.5	22	07	11.26	14	40	00.98	54	04.84
	2.0	22	30	30.31	-12	55	17.82	54	07.72

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Apr.	1.0	21	43	33.90	-16	15	38.26	54	03.87
	1.5	22	07	11.26	14	40	00.98	54	04.84
	2.0	22	30	30.31	12	55	17.82	54	07.72
	2.5	22	53	33.80	11	02	29.93	54	12.38
	3.0	23	16	25.00	9	02	40.14	54	18.63
	3.5	23	39	07.60	6	56	53.18	54	26.32
	4.0	0	01	45.67	-4	46	16.06	54	35.28
	4.5	0	24	23.56	2	31	58.47	54	45.35
	5.0	0	47	05.84	-0	15	13.27	54	56.40
	5.5	1	09	57.28	+2	02	42.98	55	08.28
	6.0	1	33	02.70	4	20	29.65	55	20.88
	6.5	1	56	26.97	6	36	41.54	55	34.11
	7.0	2	20	14.83	+8	49	48.70	55	47.86
	7.5	2	44	30.82	10	58	16.27	56	02.09
	8.0	3	09	19.06	13	00	24.68	56	16.74
	8.5	3	34	43.06	14	54	30.19	56	31.78
	9.0	4	00	45.47	16	38	45.91	56	47.17
	9.5	4	27	27.83	18	11	23.45	57	02.90
	10.0	4	54	50.26	+19	30	35.36	57	18.92
	10.5	5	22	51.29	20	34	38.22	57	35.21
	11.0	5	51	27.68	21	21	56.61	57	51.68
	11.5	6	20	34.44	21	51	07.48	58	08.25
	12.0	6	50	05.05	22	01	04.75	58	24.80
	12.5	7	19	51.81	21	51	03.56	58	41.15
	13.0	7	49	46.41	+21	20	43.69	58	57.10
	13.5	8	19	40.58	20	30	11.72	59	12.37
	14.0	8	49	26.75	19	20	01.62	59	26.68
	14.5	9	18	58.60	17	51	13.89	59	39.68
	15.0	9	48	11.44	16	05	13.43	59	51.01
	15.5	10	17	02.40	14	03	46.50	60	00.29
	16.0	10	45	30.42	+11	48	57.19	60	07.16
	16.5	11	13	36.09	9	23	03.74	60	11.28
	17.0	11	41	21.37	6	48	34.89	60	12.36
	17.5	12	08	49.30	4	08	06.37	60	10.20
	18.0	12	36	03.58	+1	24	17.60	60	04.67
	18.5	13	03	08.31	-1	20	11.55	59	55.78
	19.0	13	30	07.63	-4	02	43.77	59	43.61
	19.5	13	57	05.41	6	40	47.23	59	28.40
	20.0	14	24	05.02	9	11	58.34	59	10.45
	20.5	14	51	09.04	11	34	04.33	58	50.16
	21.0	15	18	19.10	13	45	05.51	58	27.99
	21.5	15	45	35.74	15	43	17.32	58	04.47
	22.0	16	12	58.29	-17	27	11.99	57	40.10
	22.5	16	40	24.92	18	55	39.75	57	15.43
	23.0	17	07	52.72	20	07	49.55	56	50.94
	23.5	17	35	17.88	21	03	09.20	56	27.11
	24.0	18	02	36.02	-21	41	24.84	56	04.37

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Apr.	24.0	18	02	36.02	-21	41	24.84	56	04.37
	24.5	18	29	42.51	22	02	39.78	55	43.09
	25.0	18	56	32.81	22	07	12.71	55	23.57
	25.5	19	23	02.85	21	55	35.41	55	06.10
	26.0	19	49	09.28	21	28	30.25	54	50.87
	26.5	20	14	49.68	20	46	47.55	54	38.03
	27.0	20	40	02.69	-19	51	23.10	54	27.71
	27.5	21	04	48.02	18	43	16.02	54	19.96
	28.0	21	29	06.41	17	23	27.07	54	14.79
	28.5	21	52	59.54	15	52	57.41	54	12.20
	29.0	22	16	29.91	14	12	47.95	54	12.12
	29.5	22	39	40.74	12	23	59.09	54	14.47
	30.0	23	02	35.82	-10	27	30.94	54	19.14
	30.5	23	25	19.40	8	24	23.86	54	25.96
May	1.0	23	47	56.13	6	15	39.21	54	34.78
	1.5	0	10	30.92	4	02	20.37	54	45.39
	2.0	0	33	08.92	-1	45	33.80	54	57.57
	2.5	0	55	55.42	+0	33	29.79	55	11.10
	3.0	1	18	55.79	+2	53	34.42	55	25.72
	3.5	1	42	15.39	5	13	17.77	55	41.19
	4.0	2	05	59.45	7	31	10.46	55	57.25
	4.5	2	30	12.93	9	45	35.62	56	13.65
	5.0	2	55	00.35	11	54	48.85	56	30.15
	5.5	3	20	25.51	13	56	58.83	56	46.54
	6.0	3	46	31.27	+15	50	08.75	57	02.62
	6.5	4	13	19.18	17	32	18.49	57	18.21
	7.0	4	40	49.21	19	01	27.97	57	33.17
	7.5	5	08	59.47	20	15	41.31	57	47.41
	8.0	5	37	46.07	21	13	11.96	58	00.82
	8.5	6	07	03.12	21	52	28.14	58	13.37
	9.0	6	36	43.01	+22	12	18.24	58	25.01
	9.5	7	06	36.85	22	11	55.38	58	35.72
	10.0	7	36	35.19	21	51	00.48	58	45.50
	10.5	8	06	28.76	21	09	43.53	58	54.33
	11.0	8	36	09.24	20	08	42.68	59	02.18
	11.5	9	05	29.86	18	49	01.70	59	09.03
	12.0	9	34	25.80	+17	12	06.14	59	14.80
	12.5	10	02	54.37	15	19	38.95	59	19.43
	13.0	10	30	54.91	13	13	36.20	59	22.81
	13.5	10	58	28.59	10	56	03.27	59	24.83
	14.0	11	25	38.11	8	29	11.78	59	25.34
	14.5	11	52	27.31	5	55	17.34	59	24.21
	15.0	12	19	00.83	+3	16	37.82	59	21.31
	15.5	12	45	23.75	+0	35	32.13	59	16.52
	16.0	13	11	41.31	-2	05	40.79	59	09.76
	16.5	13	37	58.56	4	44	43.06	59	00.98
	17.0	14	04	20.15	-7	19	19.05	58	50.19

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
May	17.0	14	04	20.15	-7	19	19.05	58	50.19
	17.5	14	30	50.03	9	47	16.93	58	37.45
	18.0	14	57	31.19	12	06	30.52	58	22.88
	18.5	15	24	25.49	14	15	01.56	58	06.67
	19.0	15	51	33.46	16	11	02.24	57	49.05
	19.5	16	18	54.15	17	52	57.88	57	30.32
	20.0	16	46	25.16	-19	19	29.55	57	10.79
	20.5	17	14	02.73	20	29	36.31	56	50.82
	21.0	17	41	41.92	21	22	36.93	56	30.77
	21.5	18	09	17.05	21	58	10.60	56	11.01
	22.0	18	36	42.06	22	16	16.64	55	51.89
	22.5	19	03	51.02	22	17	13.14	55	33.76
	23.0	19	30	38.57	-22	01	34.55	55	16.93
	23.5	19	57	00.33	21	30	08.68	55	01.70
	24.0	20	22	53.10	20	43	53.29	54	48.31
	24.5	20	48	15.03	19	43	52.68	54	36.99
	25.0	21	13	05.66	18	31	14.70	54	27.92
	25.5	21	37	25.77	17	07	08.26	54	21.24
	26.0	22	01	17.32	-15	32	41.48	54	17.06
	26.5	22	24	43.26	13	49	00.63	54	15.44
	27.0	22	47	47.34	11	57	09.65	54	16.43
	27.5	23	10	33.98	9	58	10.25	54	20.00
	28.0	23	33	08.12	7	53	02.53	54	26.11
	28.5	23	55	35.10	5	42	45.96	54	34.69
	29.0	0	18	00.60	-3	28	20.65	54	45.60
	29.5	0	40	30.53	-1	10	48.82	54	58.69
	30.0	1	03	10.96	+1	08	43.52	55	13.76
	30.5	1	26	08.06	3	29	04.91	55	30.55
	31.0	1	49	28.00	5	48	56.80	55	48.80
	31.5	2	13	16.81	8	06	52.07	56	08.19
June	1.0	2	37	40.24	+10	21	13.88	56	28.38
	1.5	3	02	43.47	12	30	15.09	56	48.99
	2.0	3	28	30.85	14	31	58.47	57	09.65
	2.5	3	55	05.54	16	24	18.06	57	29.97
	3.0	4	22	29.03	18	05	01.82	57	49.56
	3.5	4	50	40.77	19	31	55.95	58	08.06
	4.0	5	19	37.84	+20	42	50.74	58	25.16
	4.5	5	49	14.70	21	35	47.76	58	40.57
	5.0	6	19	23.33	22	09	07.69	58	54.06
	5.5	6	49	53.63	22	21	37.77	59	05.47
	6.0	7	20	34.13	22	12	37.76	59	14.72
	6.5	7	51	13.01	21	42	03.35	59	21.76
	7.0	8	21	39.10	+20	50	26.31	59	26.63
	7.5	8	51	42.88	19	38	51.68	59	29.42
	8.0	9	21	17.09	18	08	52.39	59	30.25
	8.5	9	50	17.09	16	22	22.55	59	29.26
	9.0	10	18	40.90	+14	21	30.56	59	26.61

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension h	m	s	Apparent Declination °	'	"	Horizontal Parallax '	"
June	9.0	10	18	40.90	+14	21	30.56	59	26.61
	9.5	10	46	28.93	12	08	32.87	59	22.49
	10.0	11	13	43.59	9	45	48.96	59	17.03
	10.5	11	40	28.85	7	15	37.88	59	10.39
	11.0	12	06	49.80	4	40	16.01	59	02.68
	11.5	12	32	52.21	+2	01	56.05	58	53.99
	12.0	12	58	42.19	-0	37	13.30	58	44.40
	12.5	13	24	25.85	3	15	07.13	58	33.97
	13.0	13	50	09.06	5	49	44.09	58	22.72
	13.5	14	15	57.18	8	19	06.15	58	10.69
	14.0	14	41	54.81	10	41	18.78	57	57.91
	14.5	15	08	05.57	12	54	31.65	57	44.42
	15.0	15	34	31.86	-14	56	59.78	57	30.25
	15.5	16	01	14.70	16	47	05.44	57	15.48
	16.0	16	28	13.54	18	23	20.45	57	00.20
	16.5	16	55	26.26	19	44	28.86	56	44.53
	17.0	17	22	49.21	20	49	29.68	56	28.61
	17.5	17	50	17.41	21	37	39.33	56	12.61
	18.0	18	17	44.90	-22	08	33.31	55	56.71
	18.5	18	45	05.17	22	22	07.00	55	41.14
	19.0	19	12	11.71	22	18	35.11	55	26.11
	19.5	19	38	58.49	21	58	30.10	55	11.85
	20.0	20	05	20.38	21	22	39.48	54	58.61
	20.5	20	31	13.51	20	32	02.49	54	46.61
	21.0	20	56	35.44	-19	27	46.61	54	36.08
	21.5	21	21	25.17	18	11	04.09	54	27.23
	22.0	21	45	43.14	16	43	08.99	54	20.26
	22.5	22	09	31.04	15	05	14.90	54	15.34
	23.0	22	32	51.69	13	18	33.32	54	12.63
	23.5	22	55	48.81	11	24	12.76	54	12.27
	24.0	23	18	26.86	-9	23	18.53	54	14.34
	24.5	23	40	50.93	7	16	53.09	54	18.93
	25.0	0	03	06.55	5	05	56.80	54	26.07
	25.5	0	25	19.66	2	51	29.17	54	35.75
	26.0	0	47	36.48	-0	34	30.27	54	47.95
	26.5	1	10	03.49	+1	43	57.50	55	02.57
	27.0	1	32	47.32	+4	02	47.53	55	19.49
	27.5	1	55	54.67	6	20	47.06	55	38.52
	28.0	2	19	32.23	8	36	35.21	55	59.43
	28.5	2	43	46.47	10	48	41.26	56	21.93
	29.0	3	08	43.40	12	55	23.24	56	45.65
	29.5	3	34	28.28	14	54	47.36	57	10.21
	30.0	4	01	05.17	+16	44	48.47	57	35.14
	30.5	4	28	36.45	18	23	12.02	57	59.94
July	1.0	4	57	02.31	19	47	38.00	58	24.10
	1.5	5	26	20.23	20	55	47.00	58	47.06
	2.0	5	56	24.70	+21	45	28.32	59	08.31

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
July	1.0	4	57	02.31	+19	47	38.00	58	24.10
	1.5	5	26	20.23	20	55	47.00	58	47.06
	2.0	5	56	24.70	21	45	28.32	59	08.31
	2.5	6	27	07.18	22	14	49.48	59	27.33
	3.0	6	58	16.49	22	22	26.02	59	43.70
	3.5	7	29	39.61	22	07	29.91	59	57.05
	4.0	8	01	02.85	+21	29	55.07	60	07.11
	4.5	8	32	13.12	20	30	18.81	60	13.72
	5.0	9	02	59.11	19	09	58.96	60	16.86
	5.5	9	33	12.12	17	30	47.41	60	16.59
	6.0	10	02	46.54	15	35	01.48	60	13.10
	6.5	10	31	39.80	13	25	14.55	60	06.66
	7.0	10	59	52.12	+11	04	07.53	59	57.58
	7.5	11	27	26.01	8	34	21.87	59	46.25
	8.0	11	54	25.69	5	58	34.55	59	33.06
	8.5	12	20	56.59	3	19	14.99	59	18.38
	9.0	12	47	04.84	+0	38	43.57	59	02.60
	9.5	13	12	56.90	-2	00	48.63	58	46.04
	10.0	13	38	39.20	-4	37	19.34	58	29.00
	10.5	14	04	17.88	7	08	54.19	58	11.72
	11.0	14	29	58.51	9	33	45.78	57	54.40
	11.5	14	55	45.91	11	50	12.95	57	37.21
	12.0	15	21	43.90	13	56	40.47	57	20.25
	12.5	15	47	55.11	15	51	39.29	57	03.62
	13.0	16	14	20.83	-17	33	47.41	56	47.37
	13.5	16	41	00.84	19	01	51.34	56	31.55
	14.0	17	07	53.45	20	14	48.02	56	16.20
	14.5	17	34	55.46	21	11	47.01	56	01.33
	15.0	18	02	02.41	21	52	12.55	55	46.99
	15.5	18	29	08.88	22	15	45.33	55	33.21
	16.0	18	56	08.87	-22	22	23.37	55	20.05
	16.5	19	22	56.29	22	12	22.12	55	07.59
	17.0	19	49	25.41	21	46	13.37	54	55.89
	17.5	20	15	31.29	21	04	43.32	54	45.06
	18.0	20	41	10.12	20	08	49.93	54	35.22
	18.5	21	06	19.35	18	59	39.85	54	26.50
	19.0	21	30	57.82	-17	38	25.41	54	19.03
	19.5	21	55	05.69	16	06	21.75	54	12.96
	20.0	22	18	44.36	14	24	44.52	54	08.43
	20.5	22	41	56.31	12	34	48.11	54	05.61
	21.0	23	04	44.93	10	37	44.48	54	04.64
	21.5	23	27	14.37	8	34	42.66	54	05.66
	22.0	23	49	29.40	-6	26	48.67	54	08.80
	22.5	0	11	35.30	4	15	06.04	54	14.16
	23.0	0	33	37.77	-2	00	36.61	54	21.85
	23.5	0	55	42.81	+0	15	38.28	54	31.93
	24.0	1	17	56.75	+2	32	36.33	54	44.44

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
July	24.0	1	17	56.75	+2	32	36.33	54	44.44
	24.5	1	40	26.10	4	49	12.61	54	59.37
	25.0	2	03	17.52	7	04	17.76	55	16.69
	25.5	2	26	37.72	9	16	36.07	55	36.30
	26.0	2	50	33.30	11	24	43.66	55	58.07
	26.5	3	15	10.54	13	27	06.84	56	21.78
	27.0	3	40	35.14	+15	22	00.97	56	47.16
	27.5	4	06	51.79	17	07	30.20	57	13.86
	28.0	4	34	03.74	18	41	28.45	57	41.45
	28.5	5	02	12.24	20	01	42.10	58	09.45
	29.0	5	31	16.01	21	05	54.84	58	37.30
	29.5	6	01	10.85	21	51	54.76	59	04.37
	30.0	6	31	49.46	+22	17	43.46	59	30.01
	30.5	7	03	01.64	22	21	46.22	59	53.56
	31.0	7	34	34.95	22	03	01.86	60	14.37
	31.5	8	06	15.72	21	21	10.59	60	31.85
Aug.	1.0	8	37	50.37	20	16	38.15	60	45.49
	1.5	9	09	06.66	18	50	35.51	60	54.92
	2.0	9	39	54.66	+17	04	54.24	60	59.90
	2.5	10	10	07.42	15	01	58.41	61	00.36
	3.0	10	39	41.13	12	44	34.81	60	56.38
	3.5	11	08	34.87	10	15	42.87	60	48.22
	4.0	11	36	50.19	7	38	25.66	60	36.25
	4.5	12	04	30.57	4	55	42.71	60	20.95
	5.0	12	31	40.82	+2	10	24.86	60	02.86
	5.5	12	58	26.56	-0	34	48.85	59	42.58
	6.0	13	24	53.82	3	17	32.61	59	20.68
	6.5	13	51	08.60	5	55	34.15	58	57.72
	7.0	14	17	16.60	8	26	54.03	58	34.20
	7.5	14	43	22.98	10	49	44.75	58	10.59
	8.0	15	09	32.08	-13	02	29.67	57	47.26
	8.5	15	35	47.29	15	03	42.15	57	24.53
	9.0	16	02	10.82	16	52	05.18	57	02.65
	9.5	16	28	43.64	18	26	31.35	56	41.81
	10.0	16	55	25.34	19	46	03.44	56	22.12
	10.5	17	22	14.21	20	49	55.32	56	03.69
	11.0	17	49	07.29	-21	37	33.10	55	46.55
	11.5	18	16	00.61	22	08	36.28	55	30.71
	12.0	18	42	49.46	22	22	58.63	55	16.18
	12.5	19	09	28.74	22	20	48.55	55	02.94
	13.0	19	35	53.40	22	02	28.82	54	50.95
	13.5	20	01	58.78	21	28	35.63	54	40.19
	14.0	20	27	40.97	-20	39	56.98	54	30.65
	14.5	20	52	57.00	19	37	30.66	54	22.31
	15.0	21	17	45.04	18	22	21.93	54	15.17
	15.5	21	42	04.41	16	55	41.19	54	09.24
	16.0	22	05	55.56	-15	18	41.85	54	04.56

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Aug.	16.0	22	05	55.56	-15	18	41.85	54	04.56
	16.5	22	29	19.96	13	32	38.47	54	01.18
	17.0	22	52	20.02	11	38	45.34	53	59.15
	17.5	23	14	58.94	9	38	15.46	53	58.55
	18.0	23	37	20.56	7	32	19.97	53	59.47
	18.5	23	59	29.28	5	22	08.00	54	02.01
	19.0	0	21	29.95	-3	08	46.81	54	06.26
	19.5	0	43	27.79	-0	53	22.32	54	12.33
	20.0	1	05	28.31	+1	23	00.10	54	20.32
	20.5	1	27	37.31	3	39	14.60	54	30.32
	21.0	1	50	00.73	5	54	13.65	54	42.40
	21.5	2	12	44.67	8	06	46.65	54	56.62
	22.0	2	35	55.26	+10	15	38.46	55	13.01
	22.5	2	59	38.51	12	19	27.99	55	31.54
	23.0	3	24	00.18	14	16	46.86	55	52.19
	23.5	3	49	05.50	16	05	58.50	56	14.83
	24.0	4	14	58.85	17	45	17.74	56	39.32
	24.5	4	41	43.39	19	12	51.51	57	05.40
	25.0	5	09	20.61	+20	26	40.67	57	32.79
	25.5	5	37	49.89	21	24	43.60	58	01.08
	26.0	6	07	08.16	22	05	01.57	58	29.80
	26.5	6	37	09.70	22	25	45.84	58	58.40
	27.0	7	07	46.29	22	25	26.02	59	26.25
	27.5	7	38	47.64	22	02	58.64	59	52.67
	28.0	8	10	02.17	+21	17	54.89	60	16.94
	28.5	8	41	18.03	20	10	25.95	60	38.34
	29.0	9	12	24.18	18	41	25.17	60	56.20
	29.5	9	43	11.31	16	52	26.61	61	09.93
	30.0	10	13	32.45	14	45	40.27	61	19.04
	30.5	10	43	23.29	12	23	44.88	61	23.22
	31.0	11	12	42.09	+9	49	39.30	61	22.34
	31.5	11	41	29.39	7	06	33.78	61	16.44
Sept.	1.0	12	09	47.57	4	17	41.80	61	05.79
	1.5	12	37	40.34	+1	26	13.19	60	50.78
	2.0	13	05	12.26	-1	24	51.20	60	31.96
	2.5	13	32	28.25	4	12	43.28	60	09.97
	3.0	13	59	33.25	-6	54	49.97	59	45.51
	3.5	14	26	31.89	9	28	54.32	59	19.27
	4.0	14	53	28.15	11	52	55.77	58	51.94
	4.5	15	20	25.22	14	05	09.83	58	24.15
	5.0	15	47	25.26	16	04	07.57	57	56.46
	5.5	16	14	29.27	17	48	35.09	57	29.37
	6.0	16	41	37.09	-19	17	33.12	57	03.26
	6.5	17	08	47.32	20	30	16.80	56	38.48
	7.0	17	35	57.52	21	26	15.60	56	15.26
	7.5	18	03	04.30	22	05	13.27	55	53.78
	8.0	18	30	03.67	-22	27	07.59	55	34.15

MOON, 2019

FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Sept.	8.0	18	30	03.67	-22	27	07.59	55	34.15
	8.5	18	56	51.27	22	32	10.00	55	16.43
	9.0	19	23	22.80	22	20	44.75	55	00.65
	9.5	19	49	34.27	21	53	27.71	54	46.79
	10.0	20	15	22.33	21	11	04.92	54	34.80
	10.5	20	40	44.46	20	14	30.81	54	24.63
	11.0	21	05	39.09	-19	04	46.41	54	16.20
	11.5	21	30	05.66	17	42	57.56	54	09.44
	12.0	21	54	04.59	16	10	13.34	54	04.26
	12.5	22	17	37.21	14	27	44.72	54	00.58
	13.0	22	40	45.67	12	36	43.48	53	58.34
	13.5	23	03	32.82	10	38	21.48	53	57.49
	14.0	23	26	02.09	-8	33	50.18	53	57.98
	14.5	23	48	17.41	6	24	20.42	53	59.79
	15.0	0	10	23.09	4	11	02.46	54	02.91
	15.5	0	32	23.76	-1	55	06.19	54	07.35
	16.0	0	54	24.32	+0	22	18.51	54	13.12
	16.5	1	16	29.87	2	40	01.19	54	20.27
	17.0	1	38	45.63	+4	56	50.23	54	28.84
	17.5	2	01	16.94	7	11	32.04	54	38.90
	18.0	2	24	09.12	9	22	50.27	54	50.49
	18.5	2	47	27.41	11	29	24.96	55	03.68
	19.0	3	11	16.85	13	29	51.85	55	18.50
	19.5	3	35	42.06	15	22	41.76	55	35.00
	20.0	4	00	47.05	+17	06	20.38	55	53.17
	20.5	4	26	34.97	18	39	08.59	56	13.00
	21.0	4	53	07.75	19	59	23.47	56	34.41
	21.5	5	20	25.86	21	05	20.29	56	57.29
	22.0	5	48	27.97	21	55	15.63	57	21.46
	22.5	6	17	10.81	22	27	31.61	57	46.68
	23.0	6	46	29.14	+22	40	41.09	58	12.64
	23.5	7	16	15.94	22	33	33.60	58	38.93
	24.0	7	46	22.85	22	05	21.16	59	05.09
	24.5	8	16	40.80	21	15	43.44	59	30.55
	25.0	8	47	00.75	20	04	51.63	59	54.73
	25.5	9	17	14.45	18	33	30.24	60	16.95
	26.0	9	47	15.08	+16	42	56.99	60	36.56
	26.5	10	16	57.67	14	35	00.58	60	52.90
	27.0	10	46	19.32	12	11	56.90	61	05.38
	27.5	11	15	19.09	9	36	24.09	61	13.52
	28.0	11	43	57.83	6	51	16.80	61	16.94
	28.5	12	12	17.83	3	59	40.25	61	15.47
	29.0	12	40	22.38	+1	04	44.33	61	09.08
	29.5	13	08	15.41	-1	50	21.98	60	57.95
	30.0	13	36	01.03	4	42	35.65	60	42.42
	30.5	14	03	43.22	7	29	03.84	60	23.01
Oct.	1.0	14	31	25.43	-10	07	07.44	60	00.30

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Oct.	1.0	14	31	25.43	-10	07	07.44	60	00.30
	1.5	14	59	10.33	12	34	23.76	59	34.98
	2.0	15	26	59.58	14	48	48.51	59	07.78
	2.5	15	54	53.62	16	48	37.11	58	39.38
	3.0	16	22	51.63	18	32	25.51	58	10.48
	3.5	16	50	51.52	19	59	10.47	57	41.68
	4.0	17	18	50.04	-21	08	09.46	57	13.53
	4.5	17	46	43.07	21	59	00.04	56	46.49
	5.0	18	14	25.85	22	31	38.78	56	20.96
	5.5	18	41	53.45	22	46	19.65	55	57.23
	6.0	19	09	01.10	22	43	31.95	55	35.52
	6.5	19	35	44.57	22	23	57.87	55	16.01
	7.0	20	02	00.45	-21	48	29.88	54	58.78
	7.5	20	27	46.36	20	58	08.12	54	43.89
	8.0	20	53	01.00	19	53	57.95	54	31.34
	8.5	21	17	44.19	18	37	07.90	54	21.09
	9.0	21	41	56.80	17	08	48.00	54	13.09
	9.5	22	05	40.60	15	30	08.59	54	07.24
	10.0	22	28	58.18	-13	42	19.63	54	03.43
	10.5	22	51	52.80	11	46	30.36	54	01.55
	11.0	23	14	28.20	9	43	49.29	54	01.48
	11.5	23	36	48.58	7	35	24.46	54	03.07
	12.0	23	58	58.44	5	22	23.92	54	06.20
	12.5	0	21	02.51	3	05	56.25	54	10.75
	13.0	0	43	05.71	-0	47	11.20	54	16.60
	13.5	1	05	13.07	+1	32	39.66	54	23.64
	14.0	1	27	29.65	3	52	22.29	54	31.79
	14.5	1	50	00.56	6	10	39.61	54	40.97
	15.0	2	12	50.78	8	26	10.95	54	51.13
	15.5	2	36	05.14	10	37	31.71	55	02.22
	16.0	2	59	48.16	+12	43	13.09	55	14.23
	16.5	3	24	03.90	14	41	42.20	55	27.13
	17.0	3	48	55.73	16	31	22.45	55	40.94
	17.5	4	14	26.17	18	10	34.45	55	55.65
	18.0	4	40	36.58	19	37	37.45	56	11.28
	18.5	5	07	26.94	20	50	51.55	56	27.81
	19.0	5	34	55.69	+21	48	40.56	56	45.24
	19.5	6	02	59.56	22	29	35.53	57	03.52
	20.0	6	31	33.70	22	52	18.75	57	22.59
	20.5	7	00	31.82	22	55	47.89	57	42.32
	21.0	7	29	46.63	22	39	19.91	58	02.57
	21.5	7	59	10.37	22	02	34.18	58	23.12
	22.0	8	28	35.40	+21	05	34.59	58	43.70
	22.5	8	57	54.87	19	48	50.39	59	03.97
	23.0	9	27	03.17	18	13	15.87	59	23.54
	23.5	9	55	56.33	16	20	08.96	59	41.96
	24.0	10	24	32.16	+14	11	09.21	59	58.76

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Oct.	24.0	10	24	32.16	+14	11	09.21	59	58.76
	24.5	10	52	50.23	11	48	15.36	60	13.42
	25.0	11	20	51.73	9	13	42.73	60	25.45
	25.5	11	48	39.20	6	30	00.56	60	34.36
	26.0	12	16	16.20	3	39	49.25	60	39.76
	26.5	12	43	46.94	+0	45	57.47	60	41.31
	27.0	13	11	15.97	-2	08	41.00	60	38.82
	27.5	13	38	47.77	5	01	10.68	60	32.21
	28.0	14	06	26.40	7	48	38.14	60	21.58
	28.5	14	34	15.16	10	28	15.94	60	07.14
	29.0	15	02	16.30	12	57	26.76	59	49.25
	29.5	15	30	30.67	15	13	47.46	59	28.38
	30.0	15	58	57.58	-17	15	12.92	59	05.07
	30.5	16	27	34.69	18	59	59.41	58	39.94
	31.0	16	56	18.02	20	26	47.29	58	13.59
	31.5	17	25	02.24	21	34	42.66	57	46.66
Nov.	1.0	17	53	40.98	22	23	17.87	57	19.71
	1.5	18	22	07.36	22	52	30.62	56	53.30
	2.0	18	50	14.55	-23	02	41.79	56	27.90
	2.5	19	17	56.32	22	54	32.16	56	03.92
	3.0	19	45	07.47	22	28	58.36	55	41.70
	3.5	20	11	44.17	21	47	08.52	55	21.53
	4.0	20	37	44.11	20	50	18.07	55	03.62
	4.5	21	03	06.48	19	39	46.07	54	48.12
	5.0	21	27	51.91	-18	16	52.26	54	35.13
	5.5	21	52	02.27	16	42	54.94	54	24.70
	6.0	22	15	40.46	14	59	09.72	54	16.83
	6.5	22	38	50.21	13	06	48.95	54	11.50
	7.0	23	01	35.89	11	07	01.82	54	08.62
	7.5	23	24	02.31	9	00	54.83	54	08.12
	8.0	23	46	14.66	-6	49	32.75	54	09.85
	8.5	0	08	18.33	4	33	59.60	54	13.68
	9.0	0	30	18.87	-2	15	19.92	54	19.44
	9.5	0	52	21.92	+0	05	19.98	54	26.94
	10.0	1	14	33.16	2	26	50.76	54	35.99
	10.5	1	36	58.22	4	47	58.92	54	46.40
	11.0	1	59	42.62	+7	07	25.77	54	57.96
	11.5	2	22	51.65	9	23	46.65	55	10.46
	12.0	2	46	30.27	11	35	30.47	55	23.72
	12.5	3	10	42.89	13	40	59.72	55	37.56
	13.0	3	35	33.19	15	38	30.96	55	51.80
	13.5	4	01	03.80	17	26	16.14	56	06.30
	14.0	4	27	16.09	+19	02	24.64	56	20.93
	14.5	4	54	09.81	20	25	06.26	56	35.60
	15.0	5	21	42.95	21	32	35.07	56	50.21
	15.5	5	49	51.55	22	23	13.96	57	04.71
	16.0	6	18	29.86	+22	55	39.54	57	19.07

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension h	m	s	Apparent Declination °	'	"	Horizontal Parallax '	"
Nov.	16.0	6	18	29.86	+22	55	39.54	57	19.07
	16.5	6	47	30.50	23	08	46.93	57	33.24
	17.0	7	16	45.06	23	01	53.71	57	47.21
	17.5	7	46	04.66	22	34	42.68	58	00.94
	18.0	8	15	20.74	21	47	22.84	58	14.40
	18.5	8	44	25.73	20	40	28.79	58	27.55
	19.0	9	13	13.62	+19	14	58.47	58	40.28
	19.5	9	41	40.32	17	32	10.10	58	52.51
	20.0	10	09	43.77	15	33	38.58	59	04.07
	20.5	10	37	23.92	13	21	12.17	59	14.78
	21.0	11	04	42.49	10	56	49.57	59	24.44
	21.5	11	31	42.70	8	22	37.77	59	32.77
	22.0	11	58	28.93	+5	40	50.48	59	39.52
	22.5	12	25	06.35	2	53	47.16	59	44.40
	23.0	12	51	40.61	+0	03	52.32	59	47.14
	23.5	13	18	17.47	-2	46	25.28	59	47.49
	24.0	13	45	02.52	5	34	33.55	59	45.24
	24.5	14	12	00.80	8	17	58.60	59	40.24
	25.0	14	39	16.47	-10	54	06.93	59	32.43
	25.5	15	06	52.47	13	20	28.36	59	21.83
	26.0	15	34	50.17	15	34	39.82	59	08.53
	26.5	16	03	09.11	17	34	29.71	58	52.74
	27.0	16	31	46.82	19	18	02.71	58	34.75
	27.5	17	00	38.79	20	43	44.39	58	14.91
	28.0	17	29	38.67	-21	50	25.35	57	53.63
	28.5	17	58	38.69	22	37	23.92	57	31.37
	29.0	18	27	30.27	23	04	27.31	57	08.58
	29.5	18	56	04.69	23	11	50.59	56	45.73
	30.0	19	24	13.91	23	00	13.88	56	23.28
	30.5	19	51	51.08	22	30	37.86	56	01.66
Dec.	1.0	20	18	51.06	-21	44	18.49	55	41.24
	1.5	20	45	10.62	20	42	41.54	55	22.39
	2.0	21	10	48.43	19	27	17.46	55	05.39
	2.5	21	35	44.95	17	59	37.26	54	50.50
	3.0	22	00	02.19	16	21	09.45	54	37.92
	3.5	22	23	43.41	14	33	18.01	54	27.80
	4.0	22	46	52.84	-12	37	21.56	54	20.25
	4.5	23	09	35.47	10	34	33.20	54	15.35
	5.0	23	31	56.82	8	26	01.11	54	13.10
	5.5	23	54	02.77	6	12	49.59	54	13.50
	6.0	0	15	59.46	3	56	00.44	54	16.50
	6.5	0	37	53.19	-1	36	34.58	54	21.99
	7.0	0	59	50.39	+0	44	26.23	54	29.86
	7.5	1	21	57.48	3	05	57.63	54	39.93
	8.0	1	44	20.90	5	26	50.85	54	52.01
	8.5	2	07	06.97	7	45	51.10	55	05.88
	9.0	2	30	21.76	+10	01	36.09	55	21.27

MOON, 2019
FOR 0^h AND 12^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			Horizontal Parallax	
		h	m	s	°	'	"	'	"
Dec.	9.0	2	30	21.76	+10	01	36.09	55	21.27
	9.5	2	54	10.98	12	12	34.97	55	37.90
	10.0	3	18	39.71	14	17	07.77	55	55.47
	10.5	3	43	52.13	16	13	25.64	56	13.65
	11.0	4	09	51.15	17	59	32.13	56	32.12
	11.5	4	36	38.07	19	33	25.65	56	50.56
	12.0	5	04	12.13	+20	53	03.53	57	08.64
	12.5	5	32	30.29	21	56	27.33	57	26.08
	13.0	6	01	27.04	22	41	49.38	57	42.61
	13.5	6	30	54.55	23	07	39.86	57	58.02
	14.0	7	00	43.11	23	12	53.50	58	12.12
	14.5	7	30	41.82	22	56	54.90	58	24.78
	15.0	8	00	39.58	+22	19	41.53	58	35.92
	15.5	8	30	26.00	21	21	44.00	58	45.52
	16.0	8	59	52.33	20	04	03.52	58	53.59
	16.5	9	28	52.02	18	28	07.30	59	00.16
	17.0	9	57	21.07	16	35	42.66	59	05.30
	17.5	10	25	18.00	14	28	51.06	59	09.10
	18.0	10	52	43.67	+12	09	42.64	59	11.64
	18.5	11	19	40.88	9	40	31.96	59	13.00
	19.0	11	46	13.99	7	03	34.95	59	13.22
	19.5	12	12	28.48	4	21	07.19	59	12.36
	20.0	12	38	30.53	+1	35	23.13	59	10.41
	20.5	13	04	26.73	-1	11	23.91	59	07.38
	21.0	13	30	23.71	-3	57	01.43	59	03.22
	21.5	13	56	27.84	6	39	17.35	58	57.88
	22.0	14	22	44.94	9	15	59.94	58	51.31
	22.5	14	49	19.96	11	44	58.19	58	43.44
	23.0	15	16	16.64	14	04	03.02	58	34.22
	23.5	15	43	37.22	16	11	09.38	58	23.63
	24.0	16	11	22.08	-18	04	19.32	58	11.67
	24.5	16	39	29.59	19	41	45.93	57	58.38
	25.0	17	07	55.93	21	01	57.76	57	43.85
	25.5	17	36	35.32	22	03	43.39	57	28.21
	26.0	18	05	20.21	22	46	15.26	57	11.62
	26.5	18	34	01.97	23	09	12.34	56	54.32
	27.0	19	02	31.48	-23	12	40.89	56	36.55
	27.5	19	30	39.98	22	57	13.17	56	18.59
	28.0	19	58	19.73	22	23	44.28	56	00.74
	28.5	20	25	24.60	21	33	27.51	55	43.31
	29.0	20	51	50.33	20	27	48.98	55	26.62
	29.5	21	17	34.67	19	08	22.27	55	10.97
	30.0	21	42	37.31	-17	36	43.59	54	56.64
	30.5	22	06	59.63	15	54	27.96	54	43.92
	31.0	22	30	44.46	14	03	06.46	54	33.04
	31.5	22	53	55.73	12	04	04.59	54	24.23
	32.0	23	16	38.29	-9	58	41.62	54	17.67

MOON, 2019
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Jan.	0	23.69	U	31	07	33.1	-7	42.8
	0		L	31	19	56.8	9	59.3
	1	24.69	U	1	08	20.6	12	07.0
	1		L	1	20	44.5	14	04.7
	2	25.69	U	2	09	08.6	15	50.9
	2		L	2	21	33.0	17	24.5
	3	26.69	U	3	09	57.5	-18	44.4
	3		L	3	22	22.3	19	49.6
	4	27.69	U	4	10	47.2	20	39.3
	4		L	4	23	12.2	21	13.0
	5	28.69	U	5	11	37.2	21	30.5
	6	29.69	L	6	00	02.1	21	31.7
	6		U	6	12	26.8	-21	16.8
	7	0.94	L	7	00	51.2	20	46.5
	7		U	7	13	15.3	20	01.3
	8	1.94	L	8	01	39.0	19	02.2
	8		U	8	14	02.3	17	50.3
	9	2.94	L	9	02	25.1	16	26.5
	9		U	9	14	47.5	-14	52.2
	10	3.94	L	10	03	09.5	13	08.4
	10		U	10	15	31.2	11	16.2
	11	4.94	L	11	03	52.7	9	16.9
	11		U	11	16	13.9	7	11.4
	12	5.94	L	12	04	35.0	5	00.9
	12		U	12	16	56.2	-2	46.4
	13	6.94	L	13	05	17.5	-0	29.0
	13		U	13	17	39.0	+1	50.1
	14	7.94	L	14	06	00.8	4	09.9
	14		U	14	18	23.2	6	28.9
	15	8.94	L	15	06	46.1	8	45.5
	15		U	15	19	09.8	+10	58.2
	16	9.94	L	16	07	34.4	13	04.9
	16		U	16	19	59.9	15	03.4
	17	10.94	L	17	08	26.5	16	51.1
	17		U	17	20	54.2	18	25.4
	18	11.94	L	18	09	23.0	19	43.4
	18		U	18	21	52.7	+20	42.2
	19	12.94	L	19	10	23.3	21	19.3
	19		U	19	22	54.6	21	32.6
	20	13.94	L	20	11	26.3	21	20.7
	20		U	20	23	58.1	20	43.4
	21	14.94	L	21	12	29.6	19	41.2
	22	15.94	U	22	01	00.7	+18	15.8
	22		L	22	13	31.0	16	29.8
	23	16.94	U	23	02	00.6	14	26.1
	23		L	23	14	29.3	+12	08.2
Jan.	24	17.94	U	24	02	57.2	+9	39.5
	24		L	24	15	24.1	7	03.5
	25	18.94	U	25	03	50.4	4	23.2
	25		L	25	16	16.0	+1	41.7
	26	19.94	U	26	04	41.0	-0	58.6
	26		L	26	17	05.7	3	35.5
	27	20.94	U	27	05	30.0	-6	06.9
	27		L	27	17	54.2	8	31.1
	28	21.94	U	28	06	18.2	10	46.6
	28		L	28	18	42.3	12	52.1
	29	22.94	U	29	07	06.4	14	46.2
	29		L	29	19	30.7	16	28.0
	30	23.94	U	30	07	55.0	-17	56.3
	30		L	30	20	19.5	19	10.4
	31	24.94	U	31	08	44.2	20	09.5
	31		L	31	21	08.9	20	53.0
Feb.	1	25.94	U	1	09	33.7	21	20.7
	1		L	1	21	58.4	21	32.4
	2	26.94	U	2	10	23.0	-21	28.0
	2		L	2	22	47.5	21	08.0
	3	27.94	U	3	11	11.6	20	32.7
	3		L	3	23	35.5	19	43.0
	4	28.94	U	4	11	59.0	18	39.6
	5	0.12	L	5	00	22.1	17	23.6
	5		U	5	12	44.9	-15	56.0
	6	1.12	L	6	01	07.2	14	18.1
	6		U	6	13	29.1	12	31.0
	7	2.12	L	7	01	50.8	10	35.9
	7		U	7	14	12.2	8	34.0
	8	3.12	L	8	02	33.3	6	26.6
	8		U	8	14	54.4	-4	14.7
	9	4.12	L	9	03	15.5	-1	59.6
	9		U	9	15	36.6	+0	17.5
	10	5.12	L	10	03	57.9	2	35.5
	10		U	10	16	19.5	4	53.2
	11	6.12	L	11	04	41.5	7	09.1
	11		U	11	17	04.0	+9	21.8
	12	7.12	L	12	05	27.2	11	29.8
	12		U	12	17	51.1	13	31.3
	13	8.12	L	13	06	15.9	15	24.3
	13		U	13	18	41.6	17	06.7
	14	9.12	L	14	07	08.4	+18	36.1
	14		U	14	19	36.1	+19	50.0
	15	10.12	L	15	08	04.8	20	46.0
	15		U	15	20	34.3	21	21.8
	16	11.12	L	16	09	04.7	+21	35.2

MOON, 2019
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Feb.	16	11.12	L	16	09	04.7	+21	35.2
	16		U	16	21	35.5	21	24.8
	17	12.12	L	17	10	06.6	20	49.7
	17		U	17	22	37.8	19	50.1
	18	13.12	L	18	11	08.7	18	27.0
	18		U	18	23	39.3	16	42.2
	19	14.12	L	19	12	09.2	+14	38.5
	20	15.12	U	20	00	38.5	12	18.8
	20		L	20	13	07.0	9	46.9
	21	16.12	U	21	01	34.8	7	06.1
	21		L	21	14	02.0	4	20.0
	22	17.12	U	22	02	28.5	+1	32.0
	22		L	22	14	54.6	-1	14.9
	23	18.12	U	23	03	20.2	3	58.0
	23		L	23	15	45.6	6	34.8
	24	19.12	U	24	04	10.7	9	03.4
	24		L	24	16	35.7	11	22.0
	25	20.12	U	25	05	00.6	13	28.9
	25		L	25	17	25.4	-15	23.1
	26	21.12	U	26	05	50.3	17	03.3
	26		L	26	18	15.3	18	28.8
	27	22.12	U	27	06	40.2	19	38.9
	27		L	27	19	05.2	20	33.1
	28	23.12	U	28	07	30.1	21	11.1
	28		L	28	19	55.0	-21	32.8
Mar.	1	24.12	U	1	08	19.7	21	38.3
	1		L	1	20	44.3	21	27.7
	2	25.12	U	2	09	08.6	21	01.7
	2		L	2	21	32.6	20	20.7
	3	26.12	U	3	09	56.2	19	25.5
	3		L	3	22	19.5	-18	17.1
	4	27.12	U	4	10	42.4	16	56.3
	4		L	4	23	05.0	15	24.3
	5	28.12	U	5	11	27.2	13	42.2
	5		L	5	23	49.1	11	51.0
	6	29.12	U	6	12	10.7	9	52.1
	7	0.33	L	7	00	32.1	-7	46.7
	7		U	7	12	53.3	5	35.9
	8	1.33	L	8	01	14.5	3	21.1
	8		U	8	13	35.7	-1	03.5
	9	2.33	L	9	01	56.9	+1	15.6
	9		U	9	14	18.4	3	34.9
	10	3.33	L	10	02	40.1	+5	53.0
	10		U	10	15	02.3	8	08.3
	11	4.33	L	11	03	24.9	10	19.4
	11		U	11	15	48.1	+12	24.7

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Mar.	11		U	11	15	48.1	+12	24.7
	12	5.33	L	12	04	12.0	14	22.2
	12		U	12	16	36.6	16	10.3
	13	6.33	L	13	05	02.0	17	46.9
	13		U	13	17	28.3	19	09.9
	14	7.33	L	14	05	55.4	20	17.2
	14		U	14	18	23.3	+21	06.8
	15	8.33	L	15	06	51.9	21	36.8
	15		U	15	19	21.1	21	45.5
	16	9.33	L	16	07	50.8	21	31.9
	16		U	16	20	20.7	20	55.1
	17	10.33	L	17	08	50.7	19	55.4
	17		U	17	21	20.6	+18	33.3
	18	11.33	L	18	09	50.2	16	50.4
	18		U	18	22	19.5	14	48.7
	19	12.33	L	19	10	48.2	12	30.9
	19		U	19	23	16.4	9	59.7
	20	13.33	L	20	11	44.1	7	18.7
	21	14.33	U	21	00	11.4	+4	31.0
	21		L	21	12	38.2	+1	40.0
	22	15.33	U	22	01	04.7	-1	11.0
	22		L	22	13	30.9	3	59.1
	23	16.33	U	23	01	56.9	6	41.4
	23		L	23	14	22.8	9	15.4
	24	17.33	U	24	02	48.6	-11	39.0
	24		L	24	15	14.4	13	50.2
	25	18.33	U	25	03	40.1	15	47.5
	25		L	25	16	05.9	17	29.7
	26	19.33	U	26	04	31.7	18	55.7
	26		L	26	16	57.4	20	05.0
	27	20.33	U	27	05	23.1	-20	57.1
	27		L	27	17	48.6	21	31.8
	28	21.33	U	28	06	14.0	21	49.4
	28		L	28	18	39.1	21	50.1
	29	22.33	U	29	07	03.8	21	34.4
	29		L	29	19	28.3	21	03.0
	30	23.33	U	30	07	52.3	-20	16.7
	30		L	30	20	15.9	19	16.4
	31	24.33	U	31	08	39.1	18	03.1
	31		L	31	21	01.9	16	37.8
Apr.	1	25.33	U	1	09	24.3	15	01.5
	1		L	1	21	46.4	13	15.4
	2	26.33	U	2	10	08.2	-11	20.5
	2		L	2	22	29.7	9	18.0
	3	27.33	U	3	10	51.1	7	09.2
	3		L	3	23	12.3	-4	55.0

MOON, 2019
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Apr.	1	25.33	U	1	09	24.3	-15	01.5
	1		L	1	21	46.4	13	15.4
	2	26.33	U	2	10	08.2	11	20.5
	2		L	2	22	29.7	9	18.0
	3	27.33	U	3	10	51.1	7	09.2
	3		L	3	23	12.3	4	55.0
	4	28.33	U	4	11	33.6	-2	36.9
	4		L	4	23	55.0	-0	16.2
	5	29.33	U	5	12	16.5	+2	05.9
	6	0.63	L	6	00	38.2	4	27.8
	6		U	6	13	00.4	6	48.0
	7	1.63	L	7	01	22.9	9	04.9
	7		U	7	13	46.0	+11	16.7
	8	2.63	L	8	02	09.7	13	21.6
	8		U	8	14	34.0	15	17.7
	9	3.63	L	9	02	59.1	17	03.0
	9		U	9	15	24.9	18	35.4
	10	4.63	L	10	03	51.4	19	52.9
	10		U	10	16	18.6	+20	53.6
	11	5.63	L	11	04	46.5	21	35.8
	11		U	11	17	14.9	21	57.9
	12	6.63	L	12	05	43.7	21	58.8
	12		U	12	18	12.7	21	37.9
	13	7.63	L	13	06	41.7	20	55.0
	13		U	13	19	10.7	+19	50.5
	14	8.63	L	14	07	39.5	18	25.4
	14		U	14	20	08.0	16	41.2
	15	9.63	L	15	08	36.0	14	39.7
	15		U	15	21	03.6	12	23.1
	16	10.63	L	16	09	30.8	9	54.1
	16		U	16	21	57.7	+7	15.3
	17	11.63	L	17	10	24.1	4	29.7
	17		U	17	22	50.3	+1	40.2
	18	12.63	L	18	11	16.4	-1	10.2
	18		U	18	23	42.3	3	58.8
	19	13.63	L	19	12	08.2	6	42.5
	20	14.63	U	20	00	34.1	-9	18.9
	20		L	20	13	00.1	11	45.4
	21	15.63	U	21	01	26.2	14	00.0
	21		L	21	13	52.5	16	00.5
	22	16.63	U	22	02	18.8	17	45.5
	22		L	22	14	45.2	19	13.7
	23	17.63	U	23	03	11.7	-20	24.2
	23		L	23	15	38.0	21	16.5
	24	18.63	U	24	04	04.2	21	50.5
	24		L	24	16	30.1	-22	06.3

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Apr.	24		L	24	16	30.1	-22	06.3
	25	19.63	U	25	04	55.8	22	04.4
	25		L	25	17	21.0	21	45.4
	26	20.63	U	26	05	45.8	21	10.3
	26		L	26	18	10.0	20	20.0
	27	21.63	U	27	06	33.8	19	15.6
	27		L	27	18	57.1	-17	58.4
	28	22.63	U	28	07	19.8	16	29.4
	28		L	28	19	42.2	14	49.7
	29	23.63	U	29	08	04.2	13	00.5
	29		L	29	20	25.8	11	02.9
	30	24.63	U	30	08	47.2	8	57.9
	30		L	30	21	08.5	-6	46.8
May	1	25.63	U	1	09	29.7	4	30.5
	1		L	1	21	51.0	-2	10.3
	2	26.63	U	2	10	12.4	+0	12.6
	2		L	2	22	34.0	2	36.8
	3	27.63	U	3	10	56.0	5	00.9
	3		L	3	23	18.4	+7	23.3
	4	28.63	U	4	11	41.3	9	42.2
	5	0.05	L	5	00	04.9	11	55.7
	5		U	5	12	29.1	14	01.7
	6	1.05	L	6	00	54.2	15	58.2
	6		U	6	13	19.9	17	42.9
	7	2.05	L	7	01	46.5	+19	13.4
	7		U	7	14	13.7	20	27.7
	8	3.05	L	8	02	41.7	21	23.6
	8		U	8	15	10.2	21	59.6
	9	4.05	L	9	03	39.1	22	14.3
	9		U	9	16	08.1	22	07.0
	10	5.05	L	10	04	37.3	+21	37.5
	10		U	10	17	06.2	20	46.1
	11	6.05	L	11	05	34.9	19	33.9
	11		U	11	18	03.2	18	02.2
	12	7.05	L	12	06	30.9	16	12.9
	12		U	12	18	58.2	14	08.0
	13	8.05	L	13	07	24.9	+11	49.8
	13		U	13	19	51.2	9	20.9
	14	9.05	L	14	08	17.0	6	43.6
	14		U	14	20	42.6	4	00.5
	15	10.05	L	15	09	07.9	+1	14.1
	15		U	15	21	33.1	-1	32.9
	16	11.05	L	16	09	58.2	-4	18.1
	16		U	16	22	23.5	6	58.9
	17	12.05	L	17	10	48.8	9	33.0
	17		U	17	23	14.4	-11	58.0

MOON, 2019
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
May	17		U	17	23	14.4	-11	58.0
	18	13.05	L	18	11	40.2	14	11.6
	19	14.05	U	19	00	06.3	16	12.0
	19		L	19	12	32.6	17	57.2
	20	15.05	U	20	00	59.1	19	25.9
	20		L	20	13	25.7	20	36.8
	21	16.05	U	21	01	52.3	-21	29.3
	21		L	21	14	18.8	22	03.0
	22	17.05	U	22	02	45.2	22	18.0
	22		L	22	15	11.2	22	14.7
	23	18.05	U	23	03	36.7	21	53.7
	23		L	23	16	01.8	21	16.2
	24	19.05	U	24	04	26.4	-20	23.2
	24		L	24	16	50.3	19	16.1
	25	20.05	U	25	05	13.7	17	55.9
	25		L	25	17	36.6	16	24.2
	26	21.05	U	26	05	59.0	14	42.1
	26		L	26	18	20.9	12	50.8
	27	22.05	U	27	06	42.4	-10	51.5
	27		L	27	19	03.7	8	45.2
	28	23.05	U	28	07	24.8	6	33.1
	28		L	28	19	45.9	4	16.2
	29	24.05	U	29	08	07.0	-1	55.6
	29		L	29	20	28.2	+0	27.6
	30	25.05	U	30	08	49.8	+2	52.0
	30		L	30	21	11.7	5	16.4
	31	26.05	U	31	09	34.1	7	39.2
	31		L	31	21	57.1	9	58.6
June	1	27.05	U	1	10	20.8	12	12.9
	1		L	1	22	45.4	14	19.8
	2	28.05	U	2	11	10.7	+16	16.9
	2		L	2	23	37.1	18	02.0
	3	29.05	U	3	12	04.2	19	32.4
	4	0.58	L	4	00	32.3	20	45.6
	4		U	4	13	01.0	21	39.4
	5	1.58	L	5	01	30.4	22	11.9
	5		U	5	14	00.1	+22	21.6
	6	2.58	L	6	02	30.0	22	08.0
	6		U	6	14	59.8	21	31.1
	7	3.58	L	7	03	29.3	20	31.6
	7		U	7	15	58.5	19	11.0
	8	4.58	L	8	04	27.0	17	31.2
	8		U	8	16	54.8	+15	34.5
	9	5.58	L	9	05	22.0	13	23.4
	9		U	9	17	48.5	11	00.6
	10	6.58	L	10	06	14.4	+8	28.5

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
June	10	6.58	L	10	06	14.4	+8	28.5
	10		U	10	18	39.9	5	49.8
	11	7.58	L	11	07	04.9	3	07.0
	11		U	11	19	29.7	+0	22.5
	12	8.58	L	12	07	54.3	-2	21.5
	12		U	12	20	18.8	5	02.7
	13	9.58	L	13	08	43.4	-7	39.0
	13		U	13	21	08.2	10	08.1
	14	10.58	L	14	09	33.2	12	28.2
	14		U	14	21	58.4	14	37.1
	15	11.58	L	15	10	24.0	16	33.2
	15		U	15	22	49.9	18	14.6
	16	12.58	L	16	11	16.0	-19	40.0
	16		U	16	23	42.4	20	48.1
	17	13.58	L	17	12	08.8	21	38.1
	18	14.58	U	18	00	35.2	22	09.6
	18		L	18	13	01.5	22	22.5
	19	15.58	U	19	01	27.5	22	17.0
	19		L	19	13	53.1	-21	53.9
	20	16.58	U	20	02	18.3	21	14.1
	20		L	20	14	42.9	20	18.7
	21	17.58	U	21	03	07.0	19	09.0
	21		L	21	15	30.4	17	46.5
	22	18.58	U	22	03	53.3	16	12.5
	22		L	22	16	15.6	-14	28.3
	23	19.58	U	23	04	37.5	12	35.3
	23		L	23	16	59.0	10	34.7
	24	20.58	U	24	05	20.1	8	27.7
	24		L	24	17	41.1	6	15.4
	25	21.58	U	25	06	01.9	3	58.7
	25		L	25	18	22.8	-1	38.9
	26	22.58	U	26	06	43.8	+0	43.0
	26		L	26	19	05.0	3	06.0
	27	23.58	U	27	07	26.6	5	28.6
	27		L	27	19	48.8	7	49.5
	28	24.58	U	28	08	11.5	10	07.3
	28		L	28	20	35.0	+12	20.0
	29	25.58	U	29	08	59.4	14	25.6
	29		L	29	21	24.7	16	22.0
	30	26.58	U	30	09	50.9	18	06.5
	30		L	30	22	18.2	19	36.6
July	1	27.58	U	1	10	46.5	20	49.6
	1		L	1	23	15.7	+21	43.0
	2	28.58	U	2	11	45.5	22	14.4
	3	0.20	L	3	00	15.9	22	22.3
	3		U	3	12	46.6	+22	05.7

MOON, 2019
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
July	1	27.58	U	1	10	46.5	+20	49.6
	1		L	1	23	15.7	21	43.0
	2	28.58	U	2	11	45.5	22	14.4
	3	0.20	L	3	00	15.9	22	22.3
	3		U	3	12	46.6	22	05.7
	4	1.20	L	4	01	17.2	21	24.6
	4		U	4	13	47.6	+20	19.6
	5	2.20	L	5	02	17.5	18	52.4
	5		U	5	14	46.8	17	05.4
	6	3.20	L	6	03	15.3	15	01.1
	6		U	6	15	43.1	12	42.6
	7	4.20	L	7	04	10.1	10	13.0
	7		U	7	16	36.5	+7	35.1
	8	5.20	L	8	05	02.2	4	52.0
	8		U	8	17	27.4	+2	06.3
	9	6.20	L	9	05	52.3	-0	39.6
	9		U	9	18	16.9	3	23.2
	10	7.20	L	10	06	41.4	6	02.6
	10		U	10	19	05.9	-8	35.5
	11	8.20	L	11	07	30.4	11	00.2
	11		U	11	19	55.2	13	14.9
	12	9.20	L	12	08	20.2	15	17.8
	12		U	12	20	45.4	17	07.5
	13	10.20	L	13	09	10.9	18	42.5
	13		U	13	21	36.6	-20	01.5
	14	11.20	L	14	10	02.6	21	03.6
	14		U	14	22	28.6	21	48.0
	15	12.20	L	15	10	54.7	22	14.3
	15		U	15	23	20.6	22	22.5
	16	13.20	L	16	11	46.3	22	12.7
	17	14.20	U	17	00	11.7	-21	45.7
	17		L	17	12	36.6	21	02.2
	18	15.20	U	18	01	01.1	20	03.5
	18		L	18	13	25.0	18	50.7
	19	16.20	U	19	01	48.3	17	25.2
	19		L	19	14	11.1	15	48.5
	20	17.20	U	20	02	33.4	-14	02.0
	20		L	20	14	55.1	12	06.9
	21	18.20	U	21	03	16.5	10	04.7
	21		L	21	15	37.5	7	56.5
	22	19.20	U	22	03	58.4	5	43.6
	22		L	22	16	19.0	3	27.0
	23	20.20	U	23	04	39.7	-1	07.8
	23		L	23	17	00.4	+1	12.8
	24	21.20	U	24	05	21.4	3	33.7
	24		L	24	17	42.7	+5	53.8

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
July	24		L	24	17	42.7	+5	53.8
	25	22.20	U	25	06	04.4	8	11.7
	25		L	25	18	26.8	10	26.0
	26	23.20	U	26	06	49.8	12	35.2
	26		L	26	19	13.7	14	37.3
	27	24.20	U	27	07	38.5	16	30.4
	27		L	27	20	04.3	+18	12.1
	28	25.20	U	28	08	31.1	19	39.9
	28		L	28	20	59.0	20	51.4
	29	26.20	U	29	09	27.8	21	43.8
	29		L	29	21	57.5	22	14.8
	30	27.20	U	30	10	27.8	22	22.5
	30		L	30	22	58.6	+22	05.5
	31	28.20	U	31	11	29.6	21	23.4
Aug.	1	29.20	L	1	00	00.5	20	16.6
	1		U	1	12	31.0	18	46.5
	2	0.87	L	2	01	01.0	16	55.1
	2		U	2	13	30.4	14	45.5
	3	1.87	L	3	01	59.0	+12	20.7
	3		U	3	14	26.9	9	44.3
	4	2.87	L	4	02	54.0	6	59.5
	4		U	4	15	20.5	4	09.8
	5	3.87	L	5	03	46.5	+1	18.3
	5		U	5	16	12.1	-1	32.2
	6	4.87	L	6	04	37.3	-4	19.1
	6		U	6	17	02.4	7	00.1
	7	5.87	L	7	05	27.4	9	33.0
	7		U	7	17	52.4	11	56.1
	8	6.87	L	8	06	17.4	14	07.6
	8		U	8	18	42.6	16	06.0
	9	7.87	L	9	07	08.0	-17	50.0
	9		U	9	19	33.5	19	18.4
	10	8.87	L	10	07	59.2	20	30.3
	10		U	10	20	25.0	21	25.0
	11	9.87	L	11	08	50.8	22	02.1
	11		U	11	21	16.6	22	21.2
	12	10.87	L	12	09	42.2	-22	22.5
	12		U	12	22	07.5	22	06.4
	13	11.87	L	13	10	32.5	21	33.5
	13		U	13	22	57.1	20	44.8
	14	12.87	L	14	11	21.2	19	41.2
	14		U	14	23	44.8	18	24.1
	15	13.87	L	15	12	07.9	-16	54.7
	16	14.87	U	16	00	30.4	15	14.4
	16		L	16	12	52.5	13	24.6
	17	15.87	U	17	01	14.1	-11	26.6

MOON, 2019
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Aug.	17	15.87	U	17	01	14.1	-11	26.6
	17		L	17	13	35.4	9	21.9
	18	16.87	U	18	01	56.3	7	11.6
	18		L	18	14	17.1	4	57.0
	19	17.87	U	19	02	37.7	2	39.3
	19		L	19	14	58.2	-0	19.7
	20	18.87	U	20	03	18.9	+2	00.7
	20		L	20	15	39.7	4	20.6
	21	19.87	U	21	04	00.8	6	38.9
	21		L	21	16	22.4	8	54.2
	22	20.87	U	22	04	44.4	11	05.2
	22		L	22	17	07.1	13	10.4
	23	21.87	U	23	05	30.6	+15	08.0
	23		L	23	17	54.9	16	56.3
	24	22.87	U	24	06	20.0	18	33.1
	24		L	24	18	46.2	19	56.3
	25	23.87	U	25	07	13.3	21	03.6
	25		L	25	19	41.4	21	52.7
	26	24.87	U	26	08	10.3	+22	21.3
	26		L	26	20	40.0	22	27.7
	27	25.87	U	27	09	10.1	22	10.3
	27		L	27	21	40.6	21	28.4
	28	26.87	U	28	10	11.1	20	22.1
	28		L	28	22	41.5	18	52.1
	29	27.87	U	29	11	11.6	+17	00.4
	29		L	29	23	41.1	14	49.2
	30	28.87	U	30	12	10.2	12	21.7
	31	0.56	L	31	00	38.6	9	41.1
	31		U	31	13	06.4	6	51.2
Sept.	1	1.56	L	1	01	33.7	3	55.5
	1		U	1	14	00.6	+0	57.5
	2	2.56	L	2	02	27.0	-1	59.5
	2		U	2	14	53.2	4	52.3
	3	3.56	L	3	03	19.2	7	38.3
	3		U	3	15	45.0	10	15.1
	4	4.56	L	4	04	10.9	12	40.4
	4		U	4	16	36.8	-14	52.5
	5	5.56	L	5	05	02.7	16	49.9
	5		U	5	17	28.8	18	31.2
	6	6.56	L	6	05	54.8	19	55.5
	6		U	6	18	20.9	21	02.0
	7	7.56	L	7	06	47.0	21	50.4
	7		U	7	19	13.0	-22	20.4
	8	8.56	L	8	07	38.8	22	32.3
	8		U	8	20	04.3	22	26.3
	9	9.56	L	9	08	29.5	-22	03.0

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Sept.	9	9.56	L	9	08	29.5	-22	03.0
	9		U	9	20	54.3	21	23.4
	10	10.56	L	10	09	18.6	20	28.4
	10		U	10	21	42.4	19	19.1
	11	11.56	L	11	10	05.7	17	56.7
	11		U	11	22	28.5	16	22.6
	12	12.56	L	12	10	50.7	-14	38.0
	12		U	12	23	12.6	12	44.3
	13	13.56	L	13	11	34.0	10	42.7
	13		U	13	23	55.2	8	34.7
	14	14.56	L	14	12	16.0	6	21.4
	15	15.56	U	15	00	36.7	4	04.2
	15		L	15	12	57.4	-1	44.2
	16	16.56	U	16	01	18.0	+0	37.2
	16		L	16	13	38.7	2	58.9
	17	17.56	U	17	01	59.6	5	19.4
	17		L	17	14	20.8	7	37.5
	18	18.56	U	18	02	42.4	9	51.9
	18		L	18	15	04.6	+12	00.9
	19	19.56	U	19	03	27.3	14	03.2
	19		L	19	15	50.6	15	57.0
	20	20.56	U	20	04	14.8	17	40.5
	20		L	20	16	39.7	19	11.9
	21	21.56	U	21	05	05.5	20	29.2
	21		L	21	17	32.1	+21	30.4
	22	22.56	U	22	05	59.5	22	13.6
	22		L	22	18	27.6	22	37.0
	23	23.56	U	23	06	56.3	22	39.1
	23		L	23	19	25.4	22	18.6
	24	24.56	U	24	07	54.8	21	35.0
	24		L	24	20	24.4	+20	28.3
	25	25.56	U	25	08	53.8	18	59.0
	25		L	25	21	23.1	17	08.6
	26	26.56	U	26	09	52.0	14	59.0
	26		L	26	22	20.5	12	32.5
	27	27.56	U	27	10	48.7	9	52.3
	27		L	27	23	16.4	+7	01.5
	28	28.56	U	28	11	43.8	4	03.6
	29	0.23	L	29	00	10.9	+1	02.1
	29		U	29	12	37.8	-1	59.5
	30	1.23	L	30	01	04.6	4	57.8
	30		U	30	13	31.2	7	49.6
Oct.	1	2.23	L	1	01	57.9	-10	32.0
	1		U	1	14	24.7	13	02.5
	2	3.23	L	2	02	51.5	15	18.7
	2		U	2	15	18.4	-17	18.9

MOON, 2019
AT EPHEMERIS TRANSIT

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Oct.	1	2.23	L	1	01	57.9	-10	32.0
	1		U	1	14	24.7	13	02.5
	2	3.23	L	2	02	51.5	15	18.7
	2		U	2	15	18.4	17	18.9
	3	4.23	L	3	03	45.4	19	01.5
	3		U	3	16	12.3	20	25.4
	4	5.23	L	4	04	39.3	-21	30.0
	4		U	4	17	06.1	22	15.1
	5	6.23	L	5	05	32.7	22	40.6
	5		U	5	17	58.9	22	47.1
	6	7.23	L	6	06	24.8	22	35.1
	6		U	6	18	50.2	22	05.7
	7	8.23	L	7	07	15.0	-21	19.8
	7		U	7	19	39.3	20	18.7
	8	9.23	L	8	08	03.0	19	03.8
	8		U	8	20	26.1	17	36.2
	9	10.23	L	9	08	48.7	15	57.3
	9		U	9	21	10.8	14	08.4
	10	11.23	L	10	09	32.4	-12	10.8
	10		U	10	21	53.7	10	05.8
	11	12.23	L	11	10	14.7	7	54.5
	11		U	11	22	35.5	5	38.2
	12	13.23	L	12	10	56.2	3	18.1
	12		U	12	23	16.8	-0	55.5
	13	14.23	L	13	11	37.6	+1	28.3
	13		U	13	23	58.4	3	52.1
	14	15.23	L	14	12	19.6	6	14.4
	15	16.23	U	15	00	41.1	8	33.8
	15		L	15	13	03.1	10	48.8
	16	17.23	U	16	01	25.5	12	57.7
	16		L	16	13	48.6	+14	58.9
	17	18.23	U	17	02	12.4	16	50.4
	17		L	17	14	36.9	18	30.6
	18	19.23	U	18	03	02.1	19	57.5
	18		L	18	15	28.0	21	09.2
	19	20.23	U	19	03	54.6	22	03.9
	19		L	19	16	21.9	+22	40.0
	20	21.23	U	20	04	49.7	22	56.1
	20		L	20	17	17.9	22	51.0
	21	22.23	U	21	05	46.3	22	24.2
	21		L	21	18	14.8	21	35.4
	22	23.23	U	22	06	43.4	20	25.0
	22		L	22	19	11.7	+18	53.7
	23	24.23	U	23	07	39.8	17	03.0
	23		L	23	20	07.5	14	54.4
	24	25.23	U	24	08	35.0	+12	30.3

Date		Age (at 0^h)		Ephemeris Transit			Geocentric Declination	
		d		d	h	m	°	'
Oct.	24	25.23	U	24	08	35.0	+12	30.3
	24		L	24	21	02.1	9	52.9
	25	26.23	U	25	09	28.9	7	05.0
	25		L	25	21	55.6	4	09.6
	26	27.23	U	26	10	22.1	+1	09.7
	26		L	26	22	48.5	-1	51.4
	27	28.23	U	27	11	15.0	-4	50.5
	27		L	27	23	41.6	7	44.4
	28	29.23	U	28	12	08.4	10	30.0
	29	0.85	L	29	00	35.4	13	04.5
	29		U	29	13	02.7	15	25.0
	30	1.85	L	30	01	30.2	17	29.3
	30		U	30	13	57.9	-19	15.4
	31	2.85	L	31	02	25.7	20	42.1
	31		U	31	14	53.4	21	48.2
Nov.	1	3.85	L	1	03	21.1	22	33.4
	1		U	1	15	48.5	22	57.8
	2	4.85	L	2	04	15.4	23	01.9
	2		U	2	16	41.9	-22	46.6
	3	5.85	L	3	05	07.8	22	13.0
	3		U	3	17	33.1	21	22.7
	4	6.85	L	4	05	57.6	20	16.9
	4		U	4	18	21.5	18	57.3
	5	7.85	L	5	06	44.7	17	25.3
	5		U	5	19	07.3	-15	42.5
	6	8.85	L	6	07	29.3	13	50.0
	6		U	6	19	50.8	11	49.3
	7	9.85	L	7	08	12.0	9	41.5
	7		U	7	20	32.9	7	27.8
	8	10.85	L	8	08	53.6	5	09.4
	8		U	8	21	14.2	-2	47.5
	9	11.85	L	9	09	34.8	-0	23.1
	9		U	9	21	55.6	+2	02.4
	10	12.85	L	10	10	16.6	4	27.8
	10		U	10	22	37.9	6	51.7
	11	13.85	L	11	10	59.7	9	12.5
	11		U	11	23	22.0	+11	28.7
	12	14.85	L	12	11	44.9	13	38.4
	13	15.85	U	13	00	08.5	15	39.9
	13		L	13	12	32.9	17	30.9
	14	16.85	U	14	00	58.0	19	09.6
	14		L	14	13	23.9	20	33.8
	15	17.85	U	15	01	50.5	+21	41.5
	15		L	15	14	17.8	22	30.9
	16	18.85	U	16	02	45.6	23	00.4
	16		L	16	15	13.7	+23	08.9

MOON, 2019
AT EPHEMERIS TRANSIT

Date		Age (at 0^h) d		Ephemeris Transit d	h	m	Geocentric Declination °	'
Nov.	16		L	16	15	13.7	+23	08.9
	17	19.85	U	17	03	42.1	22	55.7
	17		L	17	16	10.5	22	20.5
	18	20.85	U	18	04	38.8	21	23.8
	18		L	18	17	06.9	20	06.3
	19	21.85	U	19	05	34.6	18	29.3
	19		L	19	18	01.9	+16	34.5
	20	22.85	U	20	06	28.8	14	23.7
	20		L	20	18	55.2	11	59.3
	21	23.85	U	21	07	21.3	9	23.4
	21		L	21	19	47.1	6	38.4
	22	24.85	U	22	08	12.6	3	47.0
	22		L	22	20	38.1	+0	51.7
	23	25.85	U	23	09	03.6	-2	04.8
	23		L	23	21	29.2	4	59.7
	24	26.85	U	24	09	55.1	7	50.1
	24		L	24	22	21.2	10	33.2
	25	27.85	U	25	10	47.7	13	06.3
	25		L	25	23	14.7	-15	26.6
	26	28.85	U	26	11	42.0	17	31.7
	27	0.37	L	27	00	09.6	19	19.3
	27		U	27	12	37.6	20	47.7
	28	1.37	L	28	01	05.6	21	55.5
	28		U	28	13	33.7	22	42.0
	29	2.37	L	29	02	01.6	-23	07.1
	29		U	29	14	29.1	23	11.0
	30	3.37	L	30	02	56.2	22	54.6
	30		U	30	15	22.6	22	19.3
Dec.	1	4.37	L	1	03	48.3	21	26.4
	1		U	1	16	13.3	20	17.7
	2	5.37	L	2	04	37.5	-18	54.9
	2		U	2	17	01.0	17	19.7
	3	6.37	L	3	05	23.7	15	33.7
	3		U	3	17	45.9	13	38.5
	4	7.37	L	4	06	07.5	11	35.5
	4		U	4	18	28.6	9	25.8
	5	8.37	L	5	06	49.4	-7	10.8
	5		U	5	19	10.0	4	51.5
	6	9.37	L	6	07	30.5	2	29.0
	6		U	6	19	51.0	-0	04.4
	7	10.37	L	7	08	11.7	+2	21.1
	7		U	7	20	32.6	4	46.4
	8	11.37	L	8	08	53.9	+7	10.2
	8		U	8	21	15.7	9	31.0
	9	12.37	L	9	09	38.1	11	47.2
	9		U	9	22	01.2	+13	57.1

Date		Age (at 0^h) d		Ephemeris Transit d	h	m	Geocentric Declination °	'
Dec.	9		U	9	22	01.2	+13	57.1
	10	13.37	L	10	10	25.1	15	58.6
	10		U	10	22	49.8	17	49.7
	11	14.37	L	11	11	15.5	19	28.0
	11		U	11	23	41.9	20	51.2
	12	15.37	L	12	12	09.3	21	57.1
	13	16.37	U	13	00	37.3	+22	43.6
	13		L	13	13	05.9	23	09.0
	14	17.37	U	14	01	34.9	23	12.0
	14		L	14	14	04.0	22	52.0
	15	18.37	U	15	02	33.1	22	09.1
	15		L	15	15	02.0	21	03.9
	16	19.37	U	16	03	30.4	+19	37.9
	16		L	16	15	58.3	17	52.7
	17	20.37	U	17	04	25.7	15	50.5
	17		L	17	16	52.4	13	33.7
	18	21.37	U	18	05	18.6	11	04.8
	18		L	18	17	44.2	8	26.3
	19	22.37	U	19	06	09.5	+5	40.7
	19		L	19	18	34.5	+2	50.6
	20	23.37	U	20	06	59.4	-0	01.8
	20		L	20	19	24.1	2	53.8
	21	24.37	U	21	07	49.0	5	43.2
	21		L	21	20	14.1	8	27.6
	22	25.37	U	22	08	39.5	-11	04.4
	22		L	22	21	05.2	13	31.3
	23	26.37	U	23	09	31.4	15	46.0
	23		L	23	21	58.1	17	46.2
	24	27.37	U	24	10	25.1	19	29.9
	24		L	24	22	52.5	20	55.2
	25	28.37	U	25	11	20.2	-22	00.8
	25		L	25	23	48.0	22	45.7
	26	29.37	U	26	12	15.8	23	09.5
	27	0.78	L	27	00	43.3	23	12.3
	27		U	27	13	10.4	22	54.7
	28	1.78	L	28	01	37.0	22	17.9
	28		U	28	14	02.9	-21	23.3
	29	2.78	L	29	02	28.1	20	12.6
	29		U	29	14	52.5	18	47.5
	30	3.78	L	30	03	16.2	17	09.9
	30		U	30	15	39.1	15	21.5
	31	4.78	L	31	04	01.4	13	24.0
	31		U	31	16	23.1	-11	18.9
	32	5.78	L	1	04	44.3	9	07.7
	32		U	1	17	05.1	6	51.6
	33	6.78	L	2	05	25.6	-4	31.8

MOON, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
Jan.	0	+6.503	-6.774	193.35	+0.44	20	112	0.331
	1	6.497	6.536	205.52	0.41	17	111	0.236
	2	6.223	5.969	217.69	0.38	13	108	0.155
	3	5.703	5.117	229.87	0.35	8	105	0.089
	4	4.960	4.033	242.06	0.33	3	101	0.041
	5	4.021	2.775	254.24	0.30	357	99	0.011
	6	+2.912	-1.405	266.43	+0.28	352	142	0.000
	7	1.667	+0.014	278.62	0.26	347	259	0.008
	8	+0.321	1.424	290.81	0.24	343	258	0.034
	9	-1.083	2.767	302.99	0.22	340	255	0.076
	10	2.494	3.993	315.18	0.20	338	252	0.133
	11	3.854	5.053	327.35	0.18	336	250	0.204
	12	-5.101	+5.906	339.53	+0.17	336	249	0.285
	13	6.166	6.512	351.70	0.15	336	248	0.376
	14	6.977	6.834	3.86	0.13	338	248	0.473
	15	7.467	6.839	16.01	0.11	340	250	0.574
	16	7.575	6.499	28.16	0.08	344	252	0.675
	17	7.258	5.797	40.30	0.06	349	255	0.771
	18	-6.498	+4.739	52.44	+0.03	354	259	0.858
	19	5.312	3.356	64.57	-0.01	0	265	0.929
	20	3.757	+1.718	76.70	0.04	7	271	0.978
	21	-1.931	-0.065	88.82	0.08	13	283	0.999
	22	+0.038	1.858	100.95	0.12	18	99	0.991
	23	1.999	3.515	113.07	0.16	22	105	0.952
	24	+3.806	-4.907	125.20	-0.20	24	108	0.887
	25	5.333	5.944	137.34	0.24	24	110	0.802
	26	6.491	6.577	149.48	0.28	23	111	0.703
	27	7.231	6.800	161.63	0.31	21	110	0.596
	28	7.544	6.635	173.78	0.35	18	108	0.489
	29	7.455	6.125	185.95	0.38	14	106	0.385
	30	+7.008	-5.322	198.12	-0.41	9	102	0.289
	31	6.260	4.282	210.29	0.44	4	98	0.203
Feb.	1	5.272	3.063	222.47	0.47	359	93	0.131
	2	4.103	1.724	234.66	0.50	354	87	0.073
	3	2.808	-0.321	246.85	0.52	349	81	0.031
	4	1.437	+1.088	259.04	0.55	344	71	0.007
	5	+0.034	+2.445	271.23	-0.57	341	307	0.000
	6	-1.363	3.698	283.43	0.59	338	262	0.012
	7	2.716	4.795	295.62	0.61	336	256	0.041
	8	3.990	5.692	307.81	0.62	336	253	0.086
	9	5.146	6.348	320.00	0.64	336	252	0.147
	10	6.143	6.730	332.18	0.65	337	251	0.222
	11	-6.935	+6.810	344.36	-0.67	340	252	0.309
	12	7.470	6.568	356.53	0.68	343	253	0.405
	13	7.697	5.993	8.70	0.70	347	256	0.508
	14	7.566	5.086	20.86	0.72	352	260	0.614
	15	-7.036	+3.868	33.01	-0.74	358	265	0.718

MOON, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
Feb.	15	-7.036	+3.868	33.01	-0.74	358	265	0.718
	16	6.089	2.382	45.16	0.77	4	271	0.815
	17	4.734	+0.705	57.30	0.79	10	278	0.897
	18	3.023	-1.056	69.44	0.82	16	286	0.958
	19	-1.056	2.767	81.57	0.85	20	301	0.993
	20	+1.025	4.286	93.70	0.89	23	77	0.997
	21	+3.050	-5.490	105.84	-0.92	24	101	0.972
	22	4.848	6.294	117.98	0.95	24	106	0.918
	23	6.279	6.664	130.12	0.98	22	107	0.843
	24	7.248	6.609	142.27	1.01	19	106	0.753
	25	7.719	6.175	154.42	1.04	15	104	0.653
	26	7.704	5.423	166.58	1.07	10	101	0.550
	27	+7.253	-4.421	178.75	-1.09	5	97	0.449
	28	6.441	3.235	190.93	1.12	0	92	0.352
Mar.	1	5.353	1.925	203.11	1.14	355	87	0.262
	2	4.073	-0.551	215.30	1.16	350	82	0.183
	3	2.683	+0.835	227.50	1.19	345	76	0.116
	4	+1.253	2.179	239.69	1.20	342	70	0.063
	5	-0.158	+3.431	251.90	-1.22	339	62	0.026
	6	1.502	4.539	264.10	1.23	337	43	0.005
	7	2.746	5.457	276.31	1.25	336	296	0.002
	8	3.865	6.142	288.51	1.26	336	264	0.018
	9	4.841	6.558	300.72	1.27	337	257	0.052
	10	5.657	6.677	312.92	1.27	339	256	0.104
	11	-6.297	+6.482	325.12	-1.28	342	256	0.172
	12	6.737	5.969	337.31	1.28	346	258	0.255
	13	6.947	5.146	349.50	1.29	351	261	0.350
	14	6.892	4.034	1.69	1.30	356	265	0.454
	15	6.530	2.674	13.86	1.31	2	270	0.563
	16	5.828	+1.125	26.03	1.32	8	276	0.672
	17	-4.767	-0.528	38.19	-1.33	14	282	0.775
	18	3.360	2.182	50.35	1.34	18	289	0.866
	19	-1.663	3.713	62.50	1.36	22	296	0.936
	20	+0.219	5.000	74.65	1.37	24	307	0.982
	21	2.138	5.936	86.80	1.39	24	11	0.998
	22	3.924	6.452	98.95	1.41	23	92	0.986
	23	+5.415	-6.530	111.10	-1.42	20	101	0.946
	24	6.487	6.195	123.26	1.44	17	102	0.883
	25	7.071	5.504	135.42	1.46	12	100	0.804
	26	7.155	4.533	147.58	1.47	7	97	0.714
	27	6.776	3.360	159.76	1.48	2	93	0.617
	28	6.003	2.057	171.94	1.50	356	88	0.518
	29	+4.926	-0.688	184.13	-1.51	351	83	0.422
	30	3.643	+0.689	196.32	1.52	347	78	0.329
	31	2.247	2.024	208.52	1.54	343	73	0.244
Apr.	1	+0.826	3.269	220.73	1.54	339	69	0.168
	2	-0.543	+4.377	232.94	-1.55	337	64	0.104

MOON, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic		The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Long.	Lat.	Colong.	Lat.	Axis	Bright Limb	
		°	°	°	°	°	°	
Apr.	1	+0.826	+3.269	220.73	-1.54	339	69	0.168
	2	-0.543	4.377	232.94	1.55	337	64	0.104
	3	1.801	5.304	245.15	1.56	336	59	0.054
	4	2.906	6.006	257.37	1.56	336	50	0.020
	5	3.832	6.444	269.59	1.56	337	18	0.003
	6	4.568	6.588	281.82	1.56	338	283	0.006
	7	-5.116	+6.417	294.04	-1.56	341	265	0.029
	8	5.483	5.926	306.26	1.55	345	262	0.071
	9	5.674	5.126	318.48	1.55	350	263	0.134
	10	5.690	4.045	330.69	1.54	355	266	0.213
	11	5.518	2.728	342.90	1.53	1	270	0.307
	12	5.138	+1.238	355.10	1.53	6	275	0.413
	13	-4.526	-0.348	7.29	-1.52	12	281	0.524
	14	3.661	1.939	19.48	1.51	17	286	0.637
	15	2.541	3.432	31.66	1.51	21	291	0.744
	16	-1.193	4.722	43.84	1.51	23	296	0.839
	17	+0.315	5.711	56.01	1.51	24	300	0.915
	18	1.878	6.321	68.18	1.50	24	306	0.968
	19	+3.361	-6.511	80.34	-1.50	22	330	0.995
	20	4.626	6.279	92.51	1.50	18	75	0.994
	21	5.556	5.664	104.68	1.50	14	93	0.968
	22	6.072	4.733	116.85	1.50	9	95	0.919
	23	6.143	3.567	129.02	1.50	4	92	0.853
	24	5.786	2.249	141.20	1.50	358	89	0.773
	25	+5.053	-0.855	153.39	-1.50	353	84	0.684
	26	4.021	+0.549	165.58	1.50	348	80	0.590
	27	2.779	1.908	177.78	1.50	344	75	0.495
	28	1.425	3.173	189.99	1.50	340	71	0.401
	29	+0.050	4.299	202.20	1.49	338	68	0.310
	30	-1.259	5.246	214.42	1.49	336	65	0.227
May	1	-2.430	+5.974	226.64	-1.49	336	62	0.152
	2	3.407	6.445	238.87	1.48	336	60	0.089
	3	4.154	6.626	251.10	1.47	338	56	0.042
	4	4.656	6.491	263.34	1.46	340	47	0.012
	5	4.915	6.027	275.58	1.45	344	336	0.002
	6	4.952	5.242	287.82	1.44	348	274	0.014
	7	-4.794	+4.161	300.05	-1.42	353	269	0.048
	8	4.467	2.834	312.29	1.40	359	271	0.105
	9	3.994	+1.330	324.52	1.38	5	274	0.182
	10	3.387	-0.267	336.74	1.36	11	279	0.276
	11	2.648	1.862	348.96	1.34	16	284	0.382
	12	1.780	3.356	1.17	1.32	20	289	0.495
	13	-0.790	-4.653	13.38	-1.30	23	292	0.609
	14	+0.300	5.667	25.58	1.28	24	295	0.718
	15	1.445	6.328	37.77	1.26	24	297	0.815
	16	2.577	6.592	49.96	1.24	22	299	0.895
	17	+3.611	-6.447	62.14	-1.22	20	301	0.954

MOON, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
May	17	+3.611	-6.447	62.14	-1.22	20	301	0.954
	18	4.455	5.913	74.32	1.21	16	308	0.989
	19	5.030	5.041	86.50	1.19	11	33	0.999
	20	5.277	3.903	98.69	1.17	6	85	0.985
	21	5.170	2.581	110.87	1.16	0	88	0.949
	22	4.714	-1.156	123.06	1.14	355	85	0.895
	23	+3.942	+0.294	135.25	-1.13	350	81	0.827
	24	2.912	1.705	147.45	1.11	345	77	0.747
	25	1.698	3.022	159.65	1.10	341	73	0.659
	26	+0.381	4.199	171.86	1.09	339	70	0.567
	27	-0.953	5.194	184.08	1.08	337	67	0.472
	28	2.217	5.973	196.30	1.07	336	65	0.378
	29	-3.334	+6.499	208.52	-1.06	336	64	0.288
	30	4.236	6.743	220.76	1.04	337	64	0.203
	31	4.872	6.676	233.00	1.03	339	64	0.129
June	1	5.212	6.280	245.24	1.01	343	64	0.069
	2	5.246	5.550	257.49	0.99	347	63	0.025
	3	4.988	4.503	269.73	0.97	352	48	0.003
	4	-4.472	+3.179	281.98	-0.95	357	284	0.005
	5	3.744	+1.646	294.23	0.92	3	275	0.032
	6	2.856	-0.003	306.48	0.89	9	278	0.084
	7	1.860	1.665	318.72	0.87	15	282	0.159
	8	-0.803	3.227	330.96	0.84	19	286	0.252
	9	+0.273	4.587	343.19	0.81	22	290	0.359
	10	+1.331	-5.659	355.41	-0.77	24	293	0.472
	11	2.334	6.376	7.63	0.74	24	294	0.587
	12	3.243	6.703	19.84	0.71	23	295	0.695
	13	4.017	6.629	32.05	0.68	20	294	0.793
	14	4.614	6.170	44.25	0.65	17	293	0.875
	15	4.996	5.369	56.44	0.62	13	291	0.938
	16	+5.131	-4.285	68.64	-0.59	8	290	0.979
	17	4.999	2.991	80.83	0.56	2	302	0.998
	18	4.596	1.567	93.02	0.54	357	79	0.996
	19	3.931	-0.091	105.21	0.51	351	83	0.972
	20	3.033	+1.367	117.41	0.49	347	80	0.931
	21	1.941	2.742	129.61	0.46	342	76	0.874
	22	+0.710	+3.983	141.81	-0.44	339	73	0.803
	23	-0.599	5.044	154.02	0.43	337	70	0.723
	24	1.914	5.890	166.23	0.41	336	68	0.634
	25	3.162	6.489	178.45	0.39	336	67	0.540
	26	4.269	6.813	190.67	0.38	337	66	0.444
	27	5.163	6.837	202.91	0.36	339	67	0.348
	28	-5.781	+6.542	215.14	-0.35	341	68	0.256
	29	6.073	5.918	227.38	0.33	345	70	0.171
	30	6.009	4.967	239.63	0.31	350	73	0.099
July	1	5.580	3.716	251.88	0.28	355	77	0.043
	2	-4.806	+2.215	264.13	-0.26	1	81	0.009

MOON, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic		The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Long.	Lat.	Colong.	Lat.	Axis	Bright Limb	
		°	°	°	°	°	°	
July	1	-5.580	+3.716	251.88	-0.28	355	77	0.043
	2	4.806	2.215	264.13	0.26	1	81	0.009
	3	3.734	+0.547	276.39	0.23	7	284	0.001
	4	2.433	-1.180	288.64	0.20	13	278	0.020
	5	-0.993	2.843	300.89	0.17	18	283	0.067
	6	+0.490	4.319	313.14	0.14	22	287	0.139
	7	+1.921	-5.503	325.38	-0.10	24	290	0.231
	8	3.215	6.321	337.62	0.07	24	292	0.337
	9	4.305	6.733	349.85	-0.03	23	292	0.449
	10	5.145	6.733	2.07	0.00	21	292	0.562
	11	5.708	6.344	14.29	+0.04	18	290	0.670
	12	5.986	5.609	26.50	0.07	14	287	0.767
	13	+5.986	-4.587	38.70	+0.11	9	284	0.850
	14	5.723	3.346	50.91	0.15	4	279	0.917
	15	5.218	1.957	63.10	0.18	358	274	0.964
	16	4.496	-0.494	75.30	0.21	353	267	0.992
	17	3.586	+0.973	87.49	0.24	348	112	1.000
	18	2.518	2.378	99.69	0.27	344	83	0.988
	19	+1.327	+3.663	111.88	+0.30	340	78	0.959
	20	+0.051	4.781	124.08	0.32	338	74	0.913
	21	-1.266	5.688	136.28	0.34	336	72	0.852
	22	2.575	6.354	148.49	0.36	336	70	0.779
	23	3.818	6.752	160.70	0.37	336	69	0.695
	24	4.936	6.861	172.91	0.39	338	69	0.604
	25	-5.862	+6.666	185.13	+0.40	340	70	0.507
	26	6.531	6.157	197.36	0.42	344	72	0.407
	27	6.879	5.335	209.59	0.43	348	75	0.308
	28	6.853	4.213	221.83	0.45	353	79	0.214
	29	6.418	2.823	234.07	0.47	359	85	0.131
	30	5.563	+1.226	246.31	0.49	5	91	0.064
	31	-4.313	-0.489	258.56	+0.51	11	101	0.019
Aug.	1	2.735	2.205	270.81	0.53	16	147	0.000
	2	-0.935	3.788	283.07	0.56	20	276	0.012
	3	+0.951	5.111	295.31	0.59	23	284	0.053
	4	2.772	6.073	307.56	0.62	24	288	0.120
	5	4.389	6.611	319.80	0.65	24	290	0.209
	6	+5.691	-6.713	332.04	+0.68	22	290	0.311
	7	6.611	6.401	344.26	0.72	19	288	0.421
	8	7.125	5.727	356.49	0.75	15	286	0.531
	9	7.245	4.757	8.70	0.79	10	282	0.636
	10	7.009	3.562	20.91	0.82	5	278	0.733
	11	6.469	2.216	33.11	0.85	360	273	0.818
	12	+5.682	-0.788	45.31	+0.89	354	267	0.888
	13	4.703	+0.656	57.50	0.92	349	260	0.942
	14	3.582	2.054	69.69	0.95	345	251	0.979
	15	2.363	3.349	81.88	0.98	341	229	0.997
	16	+1.082	+4.489	94.07	+1.00	338	102	0.997

MOON, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date		The Earth's Selenographic		The Sun's Selenographic		Position Angle of		Fraction Illuminated
0^h TT		Long.	Lat.	Colong.	Lat.	Axis	Bright Limb	
		°	°	°	°	°	°	
Aug.	16	+1.082	+4.489	94.07	+1.00	338	102	0.997
	17	-0.229	5.432	106.26	1.02	337	82	0.979
	18	1.541	6.141	118.45	1.04	336	76	0.944
	19	2.820	6.588	130.64	1.05	336	73	0.893
	20	4.033	6.754	142.84	1.06	337	72	0.828
	21	5.135	6.627	155.03	1.07	340	72	0.750
	22	-6.077	+6.201	167.24	+1.08	343	74	0.661
	23	6.799	5.480	179.45	1.08	346	76	0.565
	24	7.238	4.477	191.66	1.09	351	80	0.462
	25	7.329	3.218	203.88	1.09	356	84	0.358
	26	7.013	1.745	216.10	1.10	2	90	0.257
	27	6.251	+0.126	228.33	1.11	8	97	0.165
	28	-5.037	-1.547	240.57	+1.12	14	104	0.088
	29	3.410	3.156	252.81	1.14	19	114	0.032
	30	-1.466	4.572	265.05	1.15	22	140	0.004
	31	+0.646	5.672	277.29	1.17	24	264	0.006
Sept.	1	2.742	6.361	289.53	1.19	24	282	0.039
	2	4.637	6.597	301.77	1.21	22	286	0.099
	3	+6.177	-6.386	314.00	+1.23	20	286	0.181
	4	7.261	5.778	326.23	1.26	16	285	0.277
	5	7.852	4.847	338.45	1.28	12	282	0.381
	6	7.963	3.678	350.66	1.31	6	278	0.487
	7	7.648	2.352	2.86	1.34	1	273	0.591
	8	6.981	-0.944	15.06	1.37	355	267	0.687
	9	+6.043	+0.480	27.26	+1.39	350	262	0.775
	10	4.913	1.860	39.45	1.42	346	256	0.850
	11	3.662	3.144	51.63	1.44	342	250	0.911
	12	2.350	4.283	63.81	1.46	339	243	0.957
	13	+1.023	5.234	75.99	1.48	337	231	0.986
	14	-0.284	5.960	88.16	1.49	336	182	0.998
	15	-1.548	+6.430	100.34	+1.50	336	95	0.992
	16	2.748	6.623	112.51	1.50	337	81	0.969
	17	3.865	6.527	124.69	1.51	339	77	0.928
	18	4.878	6.139	136.87	1.50	342	76	0.871
	19	5.754	5.465	149.05	1.50	345	78	0.799
	20	-6.453	4.525	161.24	1.49	350	80	0.713
	21	-6.921	+3.346	173.43	+1.49	355	84	0.617
	22	7.098	1.970	185.62	1.48	0	89	0.513
	23	6.920	+0.452	197.83	1.47	6	95	0.406
	24	6.333	-1.134	210.03	1.47	12	101	0.299
	25	5.306	2.695	222.25	1.46	17	107	0.199
	26	3.849	4.119	234.47	1.46	21	113	0.114
	27	-2.028	-5.291	246.69	+1.46	23	121	0.049
	28	+0.030	6.102	258.92	1.46	24	136	0.011
	29	2.146	6.478	271.14	1.47	23	237	0.003
	30	4.124	6.394	283.37	1.47	21	276	0.025
Oct.	1	+5.783	-5.875	295.59	+1.48	18	281	0.074

MOON, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic Long.	The Earth's Selenographic Lat.	The Sun's Selenographic Colong.	The Sun's Selenographic Lat.	Position Angle of Axis	Position Angle of Bright Limb	Fraction Illuminated
		°	°	°	°	°	°	
Oct.	1	+5.783	-5.875	295.59	+1.48	18	281	0.074
	2	6.995	4.990	307.81	1.49	13	280	0.146
	3	7.697	3.831	320.02	1.51	8	278	0.233
	4	7.887	2.493	332.23	1.52	3	273	0.330
	5	7.611	-1.066	344.43	1.53	357	268	0.431
	6	6.946	+0.375	356.63	1.55	352	263	0.531
	7	+5.982	+1.767	8.81	+1.56	347	258	0.628
	8	4.811	3.057	21.00	1.57	343	253	0.718
	9	3.520	4.200	33.17	1.59	340	248	0.799
	10	2.183	5.157	45.34	1.60	337	244	0.868
	11	+0.859	5.892	57.51	1.60	336	240	0.925
	12	-0.405	6.377	69.67	1.60	336	234	0.966
	13	-1.580	+6.587	81.83	+1.60	337	220	0.991
	14	2.648	6.506	93.99	1.60	338	143	0.998
	15	3.600	6.131	106.15	1.59	341	91	0.987
	16	4.427	5.469	118.30	1.58	344	83	0.956
	17	5.118	4.540	130.46	1.56	349	82	0.907
	18	5.654	3.377	142.63	1.54	354	85	0.841
	19	-6.004	+2.026	154.79	+1.52	359	88	0.759
	20	6.127	+0.547	166.97	1.50	5	93	0.664
	21	5.974	-0.992	179.14	1.48	10	99	0.559
	22	5.498	2.508	191.32	1.45	15	104	0.449
	23	4.666	3.908	203.51	1.43	19	109	0.338
	24	3.473	5.094	215.71	1.42	22	114	0.233
	25	-1.957	-5.968	227.91	+1.40	24	118	0.141
	26	-0.210	6.450	240.11	1.38	24	122	0.069
	27	+1.631	6.492	252.32	1.37	22	129	0.021
	28	3.400	6.088	264.53	1.36	19	176	0.002
	29	4.933	5.281	276.74	1.35	15	267	0.011
	30	6.098	4.152	288.95	1.35	10	275	0.047
	31	+6.814	-2.800	301.16	+1.34	5	273	0.106
Nov.	1	7.057	-1.328	313.36	1.34	359	270	0.181
	2	6.850	+0.172	325.55	1.34	353	265	0.268
	3	6.251	1.623	337.74	1.34	348	260	0.363
	4	5.341	2.966	349.92	1.34	344	256	0.459
	5	4.207	4.152	2.10	1.34	340	251	0.556
	6	+2.940	+5.146	14.27	+1.34	338	248	0.648
	7	1.623	5.914	26.43	1.34	337	245	0.735
	8	+0.330	6.431	38.59	1.33	336	243	0.813
	9	-0.880	6.674	50.74	1.32	337	241	0.881
	10	1.962	6.627	62.89	1.31	338	239	0.935
	11	2.887	6.280	75.04	1.30	340	235	0.974
	12	-3.641	+5.636	87.18	+1.28	343	220	0.995
	13	4.219	4.711	99.32	1.25	347	111	0.997
	14	4.621	3.539	111.46	1.23	352	90	0.978
	15	4.848	2.169	123.60	1.20	358	89	0.938
	16	-4.899	+0.665	135.75	+1.17	3	92	0.878

MOON, 2019
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h TERRESTRIAL TIME

Date 0^h TT		The Earth's Selenographic		The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Long.	Lat.	Colong.	Lat.	Axis	Bright Limb	
		°	°	°	°	°	°	
Nov.	16	-4.899	+0.665	135.75	+1.17	3	92	0.878
	17	4.763	-0.897	147.90	1.13	9	97	0.800
	18	4.426	2.429	160.05	1.10	14	102	0.706
	19	3.870	3.843	172.21	1.06	19	107	0.600
	20	3.086	5.049	184.37	1.03	22	111	0.488
	21	2.078	5.962	196.55	1.00	24	114	0.375
	22	-0.876	-6.513	208.73	+0.96	24	116	0.267
	23	+0.461	6.652	220.91	0.94	23	117	0.171
	24	1.843	6.363	233.10	0.91	21	118	0.092
	25	3.163	5.665	245.29	0.88	17	119	0.036
	26	4.309	4.614	257.49	0.86	13	127	0.006
	27	5.182	3.294	269.69	0.84	7	251	0.002
	28	+5.714	-1.806	281.88	+0.82	2	269	0.023
	29	5.869	-0.252	294.08	0.80	356	267	0.067
	30	5.649	+1.278	306.27	0.79	350	263	0.128
Dec.	1	5.085	2.709	318.45	0.77	345	258	0.204
	2	4.230	3.981	330.63	0.76	342	254	0.289
	3	3.154	5.054	342.81	0.75	339	251	0.380
	4	+1.933	+5.894	354.97	+0.74	337	248	0.474
	5	+0.649	6.477	7.14	0.73	336	246	0.568
	6	-0.621	6.786	19.29	0.72	336	245	0.660
	7	1.805	6.805	31.44	0.70	337	244	0.746
	8	2.841	6.526	43.59	0.68	339	245	0.825
	9	3.679	5.945	55.73	0.66	342	246	0.893
	10	-4.284	+5.072	67.86	+0.64	346	247	0.946
	11	4.637	3.930	79.99	0.61	351	248	0.983
	12	4.734	2.562	92.12	0.58	356	229	0.999
	13	4.585	+1.030	104.25	0.54	2	94	0.993
	14	4.209	-0.585	116.38	0.50	8	95	0.963
	15	3.633	2.187	128.52	0.47	13	99	0.910
	16	-2.890	-3.674	140.65	+0.42	18	104	0.835
	17	2.013	4.951	152.79	0.38	21	108	0.743
	18	1.039	5.931	164.94	0.34	23	111	0.638
	19	-0.007	6.550	177.09	0.30	24	113	0.525
	20	+1.042	6.766	189.25	0.26	23	114	0.411
	21	2.060	6.568	201.42	0.23	21	114	0.302
	22	+2.999	-5.972	213.59	+0.19	18	112	0.203
	23	3.809	5.021	225.77	0.16	14	110	0.121
	24	4.441	3.784	237.96	0.12	9	106	0.058
	25	4.854	2.345	250.14	0.09	4	102	0.017
	26	5.016	-0.798	262.33	0.07	358	103	0.001
	27	4.910	+0.766	274.52	0.04	352	267	0.007
	28	+4.533	+2.260	286.71	+0.02	347	263	0.034
	29	3.896	3.617	298.90	0.00	343	259	0.081
	30	3.027	4.780	311.08	-0.02	340	255	0.142
	31	1.969	5.711	323.26	0.04	337	251	0.216
	32	+0.774	+6.382	335.43	-0.06	336	249	0.299

MERCURY, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ′ ″	° ′ ″			° ′ ″	° ′ ″	
Jan. 0	222 41 50.2	+0 43 07.4	0.445 7221	Feb. 15	16 29 03.9	-3 43 59.9	0.337 5629
1	225 40 26.3	+0 21 14.7	0.448 9366	16	21 48 35.3	3 09 55.9	0.332 5948
2	228 36 35.1	-0 00 23.4	0.451 8953	17	27 17 07.8	2 33 09.6	0.327 9335
3	231 30 32.4	0 21 45.3	0.454 5939	18	32 54 27.0	1 53 55.2	0.323 6312
4	234 22 33.2	0 42 49.5	0.457 0283	19	38 40 09.4	1 12 32.4	0.319 7399
5	237 12 52.2	1 03 34.8	0.459 1952	20	44 33 41.5	-0 29 26.7	0.316 3099
6	240 01 43.4	-1 23 59.8	0.461 0919	21	50 34 19.5	+0 14 50.5	0.313 3883
7	242 49 20.3	1 44 03.5	0.462 7157	22	56 41 08.7	0 59 42.7	0.311 0174
8	245 35 56.3	2 03 44.9	0.464 0649	23	62 53 04.1	1 44 29.5	0.309 2332
9	248 21 44.4	2 23 02.8	0.465 1377	24	69 08 51.6	2 28 27.6	0.308 0636
10	251 06 57.1	2 41 56.2	0.465 9329	25	75 27 08.9	3 10 53.0	0.307 5273
11	253 51 47.0	3 00 24.1	0.466 4497	26	81 46 28.3	3 51 03.3	0.307 6332
12	256 36 26.4	-3 18 25.4	0.466 6873	27	88 05 19.1	+4 28 19.3	0.308 3796
13	259 21 07.6	3 35 59.1	0.466 6456	28	94 22 10.5	5 02 07.1	0.309 7542
14	262 06 02.8	3 53 03.8	0.466 3247	Mar. 1	100 35 34.5	5 31 59.8	0.311 7351
15	264 51 24.1	4 09 38.4	0.465 7247	2	106 44 09.1	5 57 38.0	0.314 2917
16	267 37 23.8	4 25 41.4	0.464 8466	3	112 46 40.3	6 18 50.4	0.317 3857
17	270 24 14.2	4 41 11.4	0.463 6912	4	118 42 04.1	6 35 33.3	0.320 9730
18	273 12 08.1	-4 56 06.6	0.462 2599	5	124 29 27.6	+6 47 50.1	0.325 0053
19	276 01 18.0	5 10 25.3	0.460 5544	6	130 08 09.6	6 55 49.9	0.329 4316
20	278 51 56.9	5 24 05.5	0.458 5768	7	135 37 40.2	6 59 46.6	0.334 1998
21	281 44 18.2	5 37 05.0	0.456 3297	8	140 57 40.5	6 59 57.4	0.339 2576
22	284 38 35.6	5 49 21.3	0.453 8161	9	146 08 01.2	6 56 41.4	0.344 5540
23	287 35 03.1	6 00 51.7	0.451 0395	10	151 08 41.7	6 50 19.1	0.350 0400
24	290 33 55.3	-6 11 33.3	0.448 0039	11	155 59 48.6	+6 41 11.1	0.355 6690
25	293 35 27.2	6 21 22.9	0.444 7141	12	160 41 34.2	6 29 37.4	0.361 3973
26	296 39 54.3	6 30 16.8	0.441 1754	13	165 14 15.8	6 15 57.1	0.367 1843
27	299 47 33.0	6 38 11.0	0.437 3940	14	169 38 13.6	6 00 28.2	0.372 9927
28	302 58 40.1	6 45 01.4	0.433 3769	15	173 53 50.8	5 43 27.0	0.378 7885
29	306 13 32.9	6 50 43.0	0.429 1322	16	178 01 31.9	5 25 08.6	0.384 5407
30	309 32 29.8	-6 55 10.7	0.424 6689	17	182 01 42.4	+5 05 46.1	0.390 2212
31	312 55 49.7	6 58 19.0	0.419 9972	18	185 54 48.4	4 45 31.4	0.395 8048
Feb. 1	316 23 52.1	7 00 01.5	0.415 1289	19	189 41 15.6	4 24 35.1	0.401 2689
2	319 56 57.4	7 00 11.9	0.410 0770	20	193 21 29.5	4 03 06.2	0.406 5934
3	323 35 26.5	6 58 43.0	0.404 8565	21	196 55 55.3	3 41 12.8	0.411 7601
4	327 19 41.1	6 55 27.3	0.399 4839	22	200 24 57.0	3 19 01.9	0.416 7530
5	331 10 03.2	-6 50 16.8	0.393 9781	23	203 48 57.9	+2 56 39.3	0.421 5580
6	335 06 55.2	6 43 03.4	0.388 3599	24	207 08 20.5	2 34 10.4	0.426 1622
7	339 10 39.6	6 33 38.3	0.382 6529	25	210 23 26.2	2 11 39.5	0.430 5546
8	343 21 38.9	6 21 53.1	0.376 8831	26	213 34 35.5	1 49 10.6	0.434 7253
9	347 40 15.0	6 07 39.2	0.371 0795	27	216 42 08.0	1 26 46.9	0.438 6656
10	352 06 49.0	5 50 48.6	0.365 2742	28	219 46 22.6	1 04 31.3	0.442 3678
11	356 41 40.5	-5 31 13.8	0.359 5023	29	222 47 36.9	+0 42 26.4	0.445 8252
12	1 25 06.9	5 08 48.8	0.353 8020	30	225 46 08.2	+0 20 34.1	0.449 0318
13	6 17 23.1	4 43 29.0	0.348 2152	31	228 42 12.7	-0 01 03.5	0.451 9826
14	11 18 40.0	4 15 12.5	0.342 7863	Apr. 1	231 36 06.2	0 22 24.9	0.454 6730
15	16 29 03.9	-3 43 59.9	0.337 5629	2	234 28 03.7	-0 43 28.6	0.457 0992

MERCURY, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ' "	° ' "			° ' "	° ' "	
Apr. 1	231 36 06.2	-0 22 24.9	0.454 6730	May 17	33 05 13.1	-1 52 39.9	0.323 5072
2	234 28 03.7	0 43 28.6	0.457 0992	18	38 51 10.3	1 11 13.5	0.319 6295
3	237 18 19.7	1 04 13.3	0.459 2578	19	44 44 56.0	-0 28 05.2	0.316 2147
4	240 07 08.4	1 24 37.7	0.461 1460	20	50 45 45.9	+0 16 13.6	0.313 3096
5	242 54 43.3	1 44 40.7	0.462 7614	21	56 52 45.2	1 01 06.2	0.310 9564
6	245 41 17.7	2 04 21.3	0.464 1020	22	63 04 48.6	1 45 52.1	0.309 1909
7	248 27 04.4	-2 23 38.5	0.465 1662	23	69 20 41.5	+2 29 47.9	0.308 0406
8	251 12 16.3	2 42 31.1	0.465 9528	24	75 39 01.7	3 12 09.8	0.307 5241
9	253 57 05.7	3 00 58.2	0.466 4609	25	81 58 21.2	3 52 15.2	0.307 6498
10	256 41 45.0	3 18 58.7	0.466 6899	26	88 17 09.3	4 29 25.2	0.308 4156
11	259 26 26.5	3 36 31.4	0.466 6396	27	94 33 55.1	5 03 06.1	0.309 8092
12	262 11 22.3	3 53 35.3	0.466 3100	28	100 47 11.1	5 32 51.1	0.311 8083
13	264 56 44.6	-4 10 08.9	0.465 7014	29	106 55 35.2	+5 58 21.3	0.314 3819
14	267 42 45.7	4 26 10.9	0.464 8147	30	112 57 53.8	6 19 25.4	0.317 4916
15	270 29 38.0	4 41 39.8	0.463 6507	31	118 53 03.3	6 35 60.0	0.321 0932
16	273 17 34.0	4 56 34.0	0.462 2109	June 1	124 40 11.1	6 48 08.7	0.325 1382
17	276 06 46.5	5 10 51.5	0.460 4969	2	130 18 36.2	6 56 00.8	0.329 5757
18	278 57 28.5	5 24 30.5	0.458 5110	3	135 47 49.3	6 59 50.3	0.334 3533
19	281 49 53.2	-5 37 28.6	0.456 2557	4	141 07 31.7	+6 59 54.3	0.339 4190
20	284 44 14.4	5 49 43.5	0.453 7339	5	146 17 34.4	6 56 32.4	0.344 7218
21	287 40 46.2	6 01 12.5	0.450 9492	6	151 17 57.0	6 50 04.7	0.350 2126
22	290 39 43.1	6 11 52.5	0.447 9057	7	156 08 46.3	6 40 51.8	0.355 8451
23	293 41 20.2	6 21 40.4	0.444 6081	8	160 50 14.9	6 29 13.9	0.361 5755
24	296 45 53.1	6 30 32.5	0.441 0618	9	165 22 40.0	6 15 30.1	0.367 3635
25	299 53 38.0	-6 38 24.8	0.437 2731	10	169 46 22.1	+5 59 58.1	0.373 1719
26	303 04 51.8	6 45 13.1	0.433 2489	11	174 01 44.2	5 42 54.4	0.378 9666
27	306 19 51.9	6 50 52.5	0.428 9973	12	178 09 11.1	5 24 33.7	0.384 7167
28	309 38 56.7	6 55 17.8	0.424 5274	13	182 09 08.2	5 05 09.5	0.390 3944
29	313 02 25.0	6 58 23.5	0.419 8496	14	186 02 01.6	4 44 53.4	0.395 9745
30	316 30 36.5	7 00 03.3	0.414 9754	15	189 48 16.9	4 23 55.9	0.401 4345
May 1	320 03 51.6	-7 00 10.7	0.409 9182	16	193 28 19.9	+4 02 26.2	0.406 7542
2	323 42 31.1	6 58 38.6	0.404 6928	17	197 02 35.4	3 40 32.2	0.411 9157
3	327 26 56.7	6 55 19.4	0.399 3160	18	200 31 27.6	3 18 20.7	0.416 9029
4	331 17 30.5	6 50 05.2	0.393 8064	19	203 55 19.7	2 55 57.9	0.421 7017
5	335 14 34.9	6 42 47.8	0.388 1853	20	207 14 34.1	2 33 28.8	0.426 2995
6	339 18 32.5	6 33 18.5	0.382 4761	21	210 29 32.3	2 10 58.0	0.430 6851
7	343 29 45.5	-6 21 28.8	0.376 7050	22	213 40 34.8	+1 48 29.1	0.434 8488
8	347 48 36.0	6 07 10.1	0.370 9010	23	216 48 01.1	1 26 05.7	0.438 7817
9	352 15 25.1	5 50 14.4	0.365 0964	24	219 52 09.9	1 03 50.4	0.442 4764
10	356 50 32.1	5 30 34.5	0.359 3262	25	222 53 19.1	0 41 45.8	0.445 9261
11	1 34 14.6	5 08 04.1	0.353 6291	26	225 51 45.7	+0 19 53.9	0.449 1249
12	6 26 47.3	4 42 38.9	0.348 0466	27	228 47 46.1	-0 01 43.3	0.452 0677
13	11 28 20.8	-4 14 16.9	0.342 6236	28	231 41 35.9	-0 23 04.1	0.454 7500
14	16 39 01.5	3 42 58.9	0.337 4075	29	234 33 30.1	0 44 07.3	0.457 1680
15	21 58 49.5	3 08 49.8	0.332 4483	30	237 23 43.4	1 04 51.3	0.459 3183
16	27 27 38.3	2 31 58.7	0.327 7974	July 1	240 12 29.7	1 25 15.1	0.461 1981
17	33 05 13.1	-1 52 39.9	0.323 5072	2	243 00 02.7	-1 45 17.5	0.462 8051

MERCURY, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector	Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector
		°	'	"	°	'	"				°	'	"	°	'	"	
July	1	240	12	29.7	-1	25	15.1	0.461 1981	Aug.	16	50	57	03.4	+0	17	35.5	0.313 2317
	2	243	00	02.7	1	45	17.5	0.462 8051		17	57	04	12.6	1	02	28.5	0.310 8958
	3	245	46	35.5	2	04	57.4	0.464 1373		18	63	16	23.9	1	47	13.4	0.309 1484
	4	248	32	21.1	2	24	13.8	0.465 1930		19	69	32	22.4	2	31	07.0	0.308 0169
	5	251	17	32.1	2	43	05.7	0.465 9711		20	75	50	45.5	3	13	25.3	0.307 5197
	6	254	02	21.2	3	01	32.0	0.466 4707		21	82	10	05.2	3	53	25.9	0.307 6647
	7	256	47	00.5	-3	19	31.7	0.466 6912		22	88	28	50.7	+4	30	30.0	0.308 4497
	8	259	31	42.3	3	37	03.5	0.466 6323		23	94	45	31.4	5	04	04.0	0.309 8618
	9	262	16	38.8	3	54	06.5	0.466 2942		24	100	58	39.6	5	33	41.6	0.311 8786
	10	265	02	02.2	4	10	39.1	0.465 6772		25	107	06	53.7	5	59	03.7	0.314 4689
	11	267	48	04.8	4	26	40.1	0.464 7820		26	113	09	00.2	6	19	59.6	0.317 5939
	12	270	34	58.9	4	42	08.0	0.463 6097		27	119	03	55.7	6	36	26.1	0.321 2095
	13	273	22	57.2	-4	57	01.1	0.462 1616		28	124	50	48.2	+6	48	26.8	0.325 2670
	14	276	12	12.3	5	11	17.4	0.460 4394		29	130	28	57.1	6	56	11.2	0.329 7154
	15	279	02	57.2	5	24	55.2	0.458 4453		30	135	57	53.2	6	59	53.6	0.334 5024
	16	281	55	25.4	5	37	52.0	0.456 1819		31	141	17	18.1	6	59	51.1	0.339 5758
	17	284	49	50.4	5	50	05.5	0.453 6521	Sept.	1	146	27	03.3	6	56	23.1	0.344 8849
	18	287	46	26.5	6	01	33.0	0.450 8596		2	151	27	08.5	6	49	50.1	0.350 3806
	19	290	45	28.1	-6	12	11.5	0.447 8084		3	156	17	40.7	+6	40	32.5	0.356 0166
	20	293	47	10.4	6	21	57.7	0.444 5033		4	160	58	52.7	6	28	50.5	0.361 7492
	21	296	51	49.0	6	30	48.0	0.440 9497		5	165	31	01.7	6	15	03.1	0.367 5383
	22	299	59	40.0	6	38	38.4	0.437 1538		6	169	54	28.4	5	59	28.0	0.373 3467
	23	303	11	00.4	6	45	24.6	0.433 1227		7	174	09	36.0	5	42	21.7	0.379 1405
	24	306	26	07.8	6	51	01.8	0.428 8645		8	178	16	48.9	5	23	58.9	0.384 8888
	25	309	45	20.4	-6	55	24.8	0.424 3883		9	182	16	32.9	+5	04	32.8	0.390 5639
	26	313	08	57.0	6	58	27.8	0.419 7045		10	186	09	13.9	4	44	15.4	0.396 1407
	27	316	37	17.4	7	00	04.9	0.414 8248		11	189	55	17.7	4	23	16.7	0.401 5968
	28	320	10	42.0	7	00	09.3	0.409 7624		12	193	35	09.9	4	01	46.1	0.406 9120
	29	323	49	31.7	6	58	34.0	0.404 5323		13	197	09	15.3	3	39	51.4	0.412 0685
	30	327	34	08.1	6	55	11.4	0.399 1513		14	200	37	58.1	3	17	39.6	0.417 0502
	31	331	24	53.4	-6	49	53.6	0.393 6382		15	204	01	41.5	+2	55	16.4	0.421 8432
Aug.	1	335	22	10.0	6	42	32.2	0.388 0142		16	207	20	47.9	2	32	47.2	0.426 4348
	2	339	26	20.3	6	32	58.7	0.382 3028		17	210	35	38.8	2	10	16.4	0.430 8139
	3	343	37	46.8	6	21	04.5	0.376 5304		18	213	46	34.4	1	47	47.6	0.434 9708
	4	347	56	51.5	6	06	41.2	0.370 7261		19	216	53	54.5	1	25	24.4	0.438 8968
	5	352	23	55.2	5	49	40.6	0.364 9221		20	219	57	57.6	1	03	09.3	0.442 5843
	6	356	59	17.5	-5	29	55.6	0.359 1537		21	222	59	01.7	+0	41	05.1	0.446 0265
	7	1	43	15.8	5	07	19.9	0.353 4595		22	225	57	23.6	+0	19	13.6	0.449 2178
	8	6	36	04.5	4	41	49.3	0.347 8812		23	228	53	19.8	-0	02	23.1	0.452 1529
	9	11	37	54.4	4	13	21.8	0.342 4639		24	231	47	05.8	0	23	43.4	0.454 8273
	10	16	48	51.5	3	41	58.6	0.337 2549		25	234	38	56.8	0	44	46.0	0.457 2374
	11	22	08	55.9	3	07	44.4	0.332 3043		26	237	29	07.2	1	05	29.4	0.459 3796
	12	27	38	00.6	-2	30	48.6	0.327 6636		27	240	17	51.0	-1	25	52.6	0.461 2514
	13	33	15	50.9	1	51	25.7	0.323 3851		28	243	05	21.9	1	45	54.2	0.462 8501
	14	39	02	02.5	1	09	55.8	0.319 5208		29	245	51	53.1	2	05	33.4	0.464 1740
	15	44	56	01.5	-0	26	44.9	0.316 1207		30	248	37	37.4	2	24	49.1	0.465 2215
	16	50	57	03.4	+0	17	35.5	0.313 2317	Oct.	1	251	22	47.6	-2	43	40.2	0.465 9913

MERCURY, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector	Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector
		°	'	"	°	'	"				°	'	"	°	'	"	
Oct.	1	251	22	47.6	-2	43	40.2	0.465 9913	Nov.	16	76	02	36.5	+3	14	41.5	0.307 5096
	2	254	07	36.1	3	02	05.7	0.466 4825		17	82	21	57.2	3	54	37.3	0.307 6744
	3	256	52	15.2	3	20	04.5	0.466 6946		18	88	40	40.9	4	31	35.4	0.308 4789
	4	259	36	57.2	3	37	35.5	0.466 6273		19	94	57	17.0	5	05	02.6	0.309 9100
	5	262	21	54.3	3	54	37.5	0.466 2808		20	101	10	17.9	5	34	32.6	0.311 9451
	6	265	07	18.6	4	11	09.2	0.465 6554		21	107	18	22.3	5	59	46.6	0.314 5526
	7	267	53	22.5	-4	27	09.2	0.464 7518		22	113	20	17.0	+6	20	34.2	0.317 6936
	8	270	40	18.3	4	42	36.1	0.463 5711		23	119	14	58.9	6	36	52.4	0.321 3238
	9	273	28	18.6	4	57	28.0	0.462 1146		24	125	01	36.3	6	48	45.0	0.325 3944
	10	276	17	36.1	5	11	43.2	0.460 3842		25	130	39	28.9	6	56	21.7	0.329 8542
	11	279	08	23.9	5	25	19.7	0.458 3819		26	136	08	08.0	6	59	56.8	0.334 6511
	12	282	00	55.3	5	38	15.3	0.456 1103		27	141	27	15.5	6	59	47.6	0.339 7329
	13	284	55	24.0	-5	50	27.4	0.453 5725		28	146	36	43.0	+6	56	13.6	0.345 0488
	14	287	52	04.2	6	01	53.4	0.450 7720		29	151	36	30.7	6	49	35.1	0.350 5498
	15	290	51	10.4	6	12	30.3	0.447 7130		30	156	26	45.6	6	40	12.7	0.356 1897
	16	293	52	57.7	6	22	14.9	0.444 4002	Dec.	1	161	07	40.6	6	28	26.5	0.361 9250
	17	296	57	41.7	6	31	03.4	0.440 8390		2	165	39	33.3	6	14	35.4	0.367 7156
	18	300	05	38.8	6	38	51.9	0.437 0357		3	170	02	44.4	5	58	57.3	0.373 5243
	19	303	17	05.8	-6	45	36.0	0.432 9975		4	174	17	36.9	+5	41	48.4	0.379 3174
	20	306	32	20.2	6	51	11.0	0.428 7324		5	178	24	35.6	5	23	23.4	0.385 0641
	21	309	51	40.4	6	55	31.6	0.424 2495		6	182	24	06.2	5	03	55.5	0.390 7368
	22	313	15	25.3	6	58	32.1	0.419 5594		7	186	16	34.5	4	43	36.6	0.396 3104
	23	316	43	54.5	7	00	06.5	0.414 6737		8	190	02	26.5	4	22	36.8	0.401 7626
	24	320	17	28.6	7	00	08.0	0.409 6058		9	193	42	07.5	4	01	05.3	0.407 0734
	25	323	56	28.5	-6	58	29.5	0.404 3706		10	197	16	02.6	+3	39	10.0	0.412 2249
	26	327	41	15.8	6	55	03.5	0.398 9851		11	200	44	35.7	3	16	57.7	0.417 2012
	27	331	32	12.6	6	49	42.0	0.393 4680		12	204	08	10.2	2	54	34.3	0.421 9882
	28	335	29	41.4	6	42	16.7	0.387 8407		13	207	27	08.3	2	32	04.9	0.426 5736
	29	339	34	04.7	6	32	39.1	0.382 1268		14	210	41	51.5	2	09	34.1	0.430 9461
	30	343	45	44.9	6	20	40.4	0.376 3527		15	213	52	40.2	1	47	05.5	0.435 0960
	31	348	05	03.9	-6	06	12.4	0.370 5476		16	216	59	53.8	+1	24	42.4	0.439 0148
Nov.	1	352	32	22.6	5	49	06.9	0.364 7438		17	220	03	51.1	1	02	27.7	0.442 6949
	2	357	08	00.5	5	29	16.7	0.358 9767		18	223	04	49.8	0	40	23.8	0.446 1295
	3	1	52	14.8	5	06	35.8	0.353 2851		19	226	03	06.9	+0	18	32.8	0.449 3130
	4	6	45	20.1	4	40	59.8	0.347 7107		20	228	58	58.8	-0	03	03.4	0.452 2401
	5	11	47	26.9	4	12	26.9	0.342 2986		21	231	52	41.0	0	24	23.2	0.454 9064
	6	16	58	41.0	-3	40	58.3	0.337 0965		22	234	44	28.6	-0	45	25.2	0.457 3083
	7	22	19	02.3	3	06	38.9	0.332 1542		23	237	34	36.0	1	06	08.0	0.459 4422
	8	27	48	23.7	2	29	38.4	0.327 5235		24	240	23	17.4	1	26	30.5	0.461 3055
	9	33	26	30.2	1	50	11.2	0.323 2567		25	243	10	46.2	1	46	31.5	0.462 8958
	10	39	12	57.1	1	08	37.7	0.319 4055		26	245	57	15.6	2	06	10.0	0.464 2112
	11	45	07	10.3	-0	25	24.1	0.316 0201		27	248	42	58.7	2	25	24.9	0.465 2500
	12	51	08	24.7	+0	18	57.9	0.313 1472		28	251	28	08.0	-2	44	15.2	0.466 0112
	13	57	15	44.9	1	03	51.3	0.310 8286		29	254	12	55.9	3	02	39.9	0.466 4937
	14	63	28	04.9	1	48	35.4	0.309 0996		30	256	57	34.9	3	20	37.8	0.466 6971
	15	69	44	09.6	2	32	26.8	0.307 9873		31	259	42	17.2	3	38	07.9	0.466 6212
	16	76	02	36.5	+3	14	41.5	0.307 5096		32	262	27	14.9	-3	55	09.0	0.466 2660

MERCURY, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	0	262	23	48.8	+0	15	02.4	Feb.	15	338	11	30.9	-1	01	30.1
	1	263	51	11.6	+0	07	25.7		16	339	57	43.3	0	52	14.3
	2	265	19	09.5	-0	00	04.0		17	341	42	35.1	0	42	17.0
	3	266	47	40.2	0	07	26.0		18	343	25	43.0	0	31	38.7
	4	268	16	42.0	0	14	39.8		19	345	06	40.7	0	20	20.1
	5	269	46	13.2	0	21	44.7		20	346	44	59.1	-0	08	23.0
	6	271	16	12.9	-0	28	40.3		21	348	20	06.4	+0	04	10.7
	7	272	46	40.1	0	35	25.9		22	349	51	28.4	0	17	17.9
	8	274	17	34.3	0	42	01.2		23	351	18	28.9	0	30	55.1
	9	275	48	55.0	0	48	25.4		24	352	40	30.1	0	44	57.9
	10	277	20	42.2	0	54	38.3		25	353	56	53.6	0	59	20.8
	11	278	52	55.8	1	00	39.2		26	355	07	00.9	1	13	57.7
	12	280	25	36.1	-1	06	27.7		27	356	10	14.6	+1	28	41.7
	13	281	58	43.4	1	12	03.2		28	357	05	59.2	1	43	24.7
	14	283	32	18.1	1	17	25.4	Mar.	1	357	53	42.3	1	57	58.1
	15	285	06	20.8	1	22	33.5		2	358	32	55.4	2	12	12.5
	16	286	40	52.1	1	27	27.2		3	359	03	15.3	2	25	57.7
	17	288	15	52.8	1	32	05.9		4	359	24	24.9	2	39	03.1
	18	289	51	23.7	-1	36	29.1		5	359	36	14.5	+2	51	17.5
	19	291	27	25.6	1	40	36.0		6	359	38	42.2	3	02	29.6
	20	293	03	59.3	1	44	26.3		7	359	31	55.7	3	12	28.0
	21	294	41	05.8	1	47	59.2		8	359	16	12.4	3	21	01.6
	22	296	18	46.0	1	51	14.1		9	358	52	00.1	3	28	00.1
	23	297	57	00.8	1	54	10.4		10	358	19	57.3	3	33	14.1
	24	299	35	51.1	-1	56	47.3		11	357	40	52.9	+3	36	35.9
	25	301	15	17.9	1	59	04.1		12	356	55	45.3	3	38	00.1
	26	302	55	21.9	2	01	00.1		13	356	05	40.9	3	37	23.3
	27	304	36	04.0	2	02	34.4		14	355	11	52.7	3	34	45.1
	28	306	17	24.8	2	03	46.2		15	354	15	37.1	3	30	08.0
	29	307	59	24.8	2	04	34.6		16	353	18	12.1	3	23	37.0
	30	309	42	04.3	-2	04	58.8		17	352	20	53.7	+3	15	19.9
	31	311	25	23.5	2	04	57.6		18	351	24	54.0	3	05	26.7
Feb.	1	313	09	22.1	2	04	30.1		19	350	31	18.7	2	54	08.8
	2	314	53	59.7	2	03	35.3		20	349	41	05.6	2	41	38.8
	3	316	39	15.6	2	02	12.1		21	348	55	03.4	2	28	09.8
	4	318	25	08.4	2	00	19.3		22	348	13	51.4	2	13	54.7
	5	320	11	36.3	-1	57	55.7		23	347	37	59.5	+1	59	05.8
	6	321	58	37.1	1	55	00.2		24	347	07	48.8	1	43	54.8
	7	323	46	07.4	1	51	31.6		25	346	43	32.4	1	28	32.0
	8	325	34	03.3	1	47	28.7		26	346	25	16.6	1	13	06.8
	9	327	22	19.8	1	42	50.1		27	346	13	01.8	0	57	47.1
	10	329	10	50.5	1	37	34.7		28	346	06	43.7	0	42	39.6
	11	330	59	28.0	-1	31	41.5		29	346	06	14.6	0	27	50.1
	12	332	48	02.8	1	25	09.3		30	346	11	24.1	+0	13	23.2
	13	334	36	24.0	1	17	57.1		31	346	21	59.7	-0	00	37.4
	14	336	24	18.5	1	10	04.2	Apr.	1	346	37	47.9	0	14	08.8
	15	338	11	30.9	-1	01	30.1		2	346	58	34.4	-0	27	08.7

MERCURY, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	346	37	47.9	-0	14	08.8	May	17	50	21	43.8	-0	27	46.8
	2	346	58	34.4	0	27	08.7		18	52	29	56.5	0	17	20.0
	3	347	24	05.0	0	39	35.4		19	54	39	15.9	-0	06	47.8
	4	347	54	05.1	0	51	27.7		20	56	49	30.6	+0	03	45.9
	5	348	28	20.8	1	02	44.6		21	59	00	27.5	0	14	17.3
	6	349	06	38.6	1	13	25.5		22	61	11	52.7	0	24	41.9
	7	349	48	45.5	-1	23	30.1		23	63	23	30.3	+0	34	55.3
	8	350	34	29.5	1	32	58.2		24	65	35	04.3	0	44	53.3
	9	351	23	39.1	1	41	49.8		25	67	46	18.0	0	54	31.4
	10	352	16	03.8	1	50	04.9		26	69	56	54.8	1	03	45.7
	11	353	11	33.7	1	57	43.6		27	72	06	38.3	1	12	32.0
	12	354	09	59.6	2	04	46.2		28	74	15	12.9	1	20	46.8
	13	355	11	13.3	-2	11	12.9		29	76	22	24.0	+1	28	26.8
	14	356	15	07.2	2	17	04.0		30	78	27	58.2	1	35	29.3
	15	357	21	34.4	2	22	19.6		31	80	31	43.7	1	41	51.7
	16	358	30	28.6	2	27	00.1	June	1	82	33	30.2	1	47	32.3
	17	359	41	44.2	2	31	05.8		2	84	33	08.8	1	52	29.2
	18	0	55	16.3	2	34	36.9		3	86	30	32.0	1	56	41.5
	19	2	11	00.3	-2	37	33.6		4	88	25	33.8	+2	00	08.3
	20	3	28	52.4	2	39	56.1		5	90	18	09.2	2	02	49.0
	21	4	48	48.9	2	41	44.8		6	92	08	14.2	2	04	43.3
	22	6	10	46.9	2	42	59.9		7	93	55	45.8	2	05	51.2
	23	7	34	43.7	2	43	41.5		8	95	40	41.4	2	06	12.9
	24	9	00	36.9	2	43	49.8		9	97	22	59.1	2	05	48.5
	25	10	28	24.5	-2	43	25.0		10	99	02	37.3	+2	04	38.5
	26	11	58	05.1	2	42	27.4		11	100	39	34.6	2	02	43.4
	27	13	29	37.3	2	40	57.1		12	102	13	49.8	2	00	03.6
	28	15	03	00.2	2	38	54.3		13	103	45	21.5	1	56	39.8
	29	16	38	13.0	2	36	19.3		14	105	14	08.5	1	52	32.6
	30	18	15	15.3	2	33	12.3		15	106	40	09.2	1	47	42.8
May	1	19	54	06.8	-2	29	33.6		16	108	03	21.8	+1	42	10.9
	2	21	34	47.7	2	25	23.4		17	109	23	44.3	1	35	57.8
	3	23	17	17.8	2	20	42.1		18	110	41	14.2	1	29	04.1
	4	25	01	37.6	2	15	30.1		19	111	55	48.7	1	21	30.7
	5	26	47	47.2	2	09	47.9		20	113	07	24.6	1	13	18.4
	6	28	35	47.0	2	03	36.0		21	114	15	58.5	1	04	28.0
	7	30	25	37.1	-1	56	55.1		22	115	21	26.1	+0	55	00.4
	8	32	17	17.7	1	49	45.9		23	116	23	43.1	0	44	56.6
	9	34	10	48.4	1	42	09.4		24	117	22	44.6	0	34	17.7
	10	36	06	08.8	1	34	06.6		25	118	18	25.1	0	23	04.8
	11	38	03	17.8	1	25	38.7		26	119	10	38.9	+0	11	19.1
	12	40	02	13.8	1	16	47.4		27	119	59	19.8	-0	00	57.9
	13	42	02	54.6	-1	07	34.1		28	120	44	21.3	-0	13	44.7
	14	44	05	16.9	0	58	01.0		29	121	25	36.5	0	26	59.6
	15	46	09	16.4	0	48	10.4		30	122	02	58.3	0	40	40.4
	16	48	14	47.6	0	38	04.6	July	1	122	36	19.4	0	54	45.0
	17	50	21	43.8	-0	27	46.8		2	123	05	32.6	-1	09	10.8

MERCURY, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	122	36	19.4	-0	54	45.0	Aug.	16	125	30	51.7	+0	05	09.3
	2	123	05	32.6	1	09	10.8		17	127	03	15.0	0	17	57.7
	3	123	30	30.5	1	23	54.7		18	128	40	03.1	0	30	00.5
	4	123	51	06.3	1	38	53.5		19	130	20	53.5	0	41	14.5
	5	124	07	13.6	1	54	03.3		20	132	05	22.2	0	51	37.2
	6	124	18	46.7	2	09	19.8		21	133	53	04.0	1	01	06.5
	7	124	25	41.1	-2	24	38.2		22	135	43	33.5	+1	09	41.0
	8	124	27	53.8	2	39	52.8		23	137	36	25.1	1	17	19.9
	9	124	25	23.6	2	54	57.8		24	139	31	13.6	1	24	02.8
	10	124	18	11.5	3	09	46.5		25	141	27	34.9	1	29	50.2
	11	124	06	21.4	3	24	11.5		26	143	25	06.0	1	34	42.8
	12	123	50	00.0	3	38	05.1		27	145	23	25.6	1	38	41.9
	13	123	29	17.7	-3	51	19.0		28	147	22	14.3	+1	41	49.2
	14	123	04	28.7	4	03	44.8		29	149	21	14.8	1	44	06.6
	15	122	35	51.4	4	15	13.6		30	151	20	11.7	1	45	36.3
	16	122	03	48.5	4	25	36.8		31	153	18	51.8	1	46	20.8
	17	121	28	47.0	4	34	46.1	Sept.	1	155	17	03.7	1	46	22.3
	18	120	51	18.0	4	42	33.6		2	157	14	37.9	1	45	43.6
	19	120	11	56.8	-4	48	52.2		3	159	11	26.7	+1	44	26.9
	20	119	31	21.7	4	53	36.1		4	161	07	23.8	1	42	35.0
	21	118	50	13.7	4	56	40.6		5	163	02	24.0	1	40	10.0
	22	118	09	15.8	4	58	02.5		6	164	56	23.5	1	37	14.4
	23	117	29	11.6	4	57	40.2		7	166	49	19.4	1	33	50.5
	24	116	50	44.7	4	55	34.0		8	168	41	09.5	1	30	00.3
	25	116	14	37.6	-4	51	45.5		9	170	31	52.5	+1	25	46.0
	26	115	41	30.9	4	46	18.0		10	172	21	27.6	1	21	09.4
	27	115	12	02.2	4	39	16.2		11	174	09	54.3	1	16	12.5
	28	114	46	46.0	4	30	46.0		12	175	57	12.8	1	10	56.8
	29	114	26	12.8	4	20	54.0		13	177	43	23.4	1	05	24.0
	30	114	10	49.2	4	09	47.8		14	179	28	26.6	0	59	35.7
	31	114	00	57.7	-3	57	35.3		15	181	12	23.3	+0	53	33.3
Aug.	1	113	56	56.5	3	44	24.7		16	182	55	14.2	0	47	18.2
	2	113	59	00.3	3	30	24.3		17	184	37	00.6	0	40	51.5
	3	114	07	20.2	3	15	42.2		18	186	17	43.2	0	34	14.7
	4	114	22	03.9	3	00	26.4		19	187	57	23.3	0	27	28.7
	5	114	43	16.5	2	44	44.6		20	189	36	01.8	0	20	34.8
	6	115	11	00.3	-2	28	44.2		21	191	13	39.8	+0	13	33.8
	7	115	45	15.2	2	12	32.3		22	192	50	18.3	+0	06	26.9
	8	116	25	59.3	1	56	15.5		23	194	25	58.0	-0	00	45.0
	9	117	13	08.6	1	40	00.3		24	196	00	39.8	0	08	01.1
	10	118	06	37.0	1	23	52.7		25	197	34	24.3	0	15	20.5
	11	119	06	17.0	1	07	58.5		26	199	07	12.2	0	22	42.2
	12	120	11	59.1	-0	52	23.1		27	200	39	03.7	-0	30	05.5
	13	121	23	31.8	0	37	11.8		28	202	09	59.2	0	37	29.6
	14	122	40	41.9	0	22	29.6		29	203	39	58.9	0	44	53.7
	15	124	03	14.3	-0	08	21.1		30	205	09	02.5	0	52	17.0
	16	125	30	51.7	+0	05	09.3	Oct.	1	206	37	09.9	-0	59	38.6

MERCURY, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Oct.	1	206	37	09.9	-0	59	38.6
	2	208	04	20.6	1	06	57.9
	3	209	30	33.7	1	14	14.0
	4	210	55	48.4	1	21	26.0
	5	212	20	03.2	1	28	33.2
	6	213	43	16.6	1	35	34.7
	7	215	05	26.5	-1	42	29.6
	8	216	26	30.5	1	49	17.0
	9	217	46	26.0	1	55	55.8
	10	219	05	09.6	2	02	25.2
	11	220	22	37.4	2	08	43.9
	12	221	38	45.0	2	14	50.8
	13	222	53	27.2	-2	20	44.6
	14	224	06	38.3	2	26	24.1
	15	225	18	11.2	2	31	47.6
	16	226	27	58.3	2	36	53.7
	17	227	35	50.8	2	41	40.6
	18	228	41	38.4	2	46	06.2
	19	229	45	09.6	-2	50	08.6
	20	230	46	11.5	2	53	45.3
	21	231	44	29.2	2	56	53.7
	22	232	39	46.0	2	59	31.0
	23	233	31	43.1	3	01	33.9
	24	234	19	59.4	3	02	58.9
	25	235	04	11.4	-3	03	42.0
	26	235	43	53.0	3	03	38.8
	27	236	18	35.3	3	02	44.4
	28	236	47	47.1	3	00	53.6
	29	237	10	54.4	2	58	00.7
	30	237	27	21.5	2	53	59.4
	31	237	36	31.1	-2	48	43.4
Nov.	1	237	37	46.3	2	42	06.1
	2	237	30	31.4	2	34	01.2
	3	237	14	15.0	2	24	22.8
	4	236	48	33.1	2	13	06.3
	5	236	13	12.3	2	00	09.0
	6	235	28	15.0	-1	45	30.9
	7	234	34	03.3	1	29	15.4
	8	233	31	23.7	1	11	30.8
	9	232	21	29.7	0	52	30.1
	10	231	06	02.4	0	32	32.0
	11	229	47	07.8	-0	11	59.5
	12	228	27	11.1	+0	08	40.6
	13	227	08	47.6	0	28	59.9
	14	225	54	31.5	0	48	30.6
	15	224	46	44.8	1	06	47.9
	16	223	47	28.3	+1	23	31.1

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Nov.	16	223	47	28.3	+1	23	31.1
	17	222	58	14.7	1	38	25.3
	18	222	20	06.2	1	51	21.5
	19	221	53	35.0	2	02	16.1
	20	221	38	46.5	2	11	09.8
	21	221	35	24.4	2	18	07.2
	22	221	42	56.0	+2	23	15.4
	23	222	00	37.4	2	26	42.6
	24	222	27	37.9	2	28	38.3
	25	223	03	04.2	2	29	11.8
	26	223	46	02.7	2	28	32.2
	27	224	35	41.9	2	26	48.4
	28	225	31	13.2	+2	24	08.3
	29	226	31	52.1	2	20	39.2
	30	227	36	58.3	2	16	27.9
Dec.	1	228	45	56.0	2	11	40.2
	2	229	58	13.1	2	06	21.3
	3	231	13	22.0	2	00	35.9
	4	232	30	58.2	+1	54	28.2
	5	233	50	40.7	1	48	01.7
	6	235	12	11.4	1	41	19.7
	7	236	35	14.6	1	34	24.9
	8	237	59	36.9	1	27	19.8
	9	239	25	07.0	1	20	06.7
	10	240	51	35.1	+1	12	47.5
	11	242	18	53.0	1	05	23.8
	12	243	46	53.8	0	57	57.4
	13	245	15	31.6	0	50	29.4
	14	246	44	41.6	0	43	01.2
	15	248	14	19.5	0	35	33.9
	16	249	44	22.2	+0	28	08.5
	17	251	14	46.8	0	20	45.9
	18	252	45	31.1	0	13	26.9
	19	254	16	33.4	+0	06	12.4
	20	255	47	52.3	-0	00	56.9
	21	257	19	26.9	0	08	00.3
	22	258	51	16.4	-0	14	57.3
	23	260	23	20.4	0	21	47.1
	24	261	55	38.5	0	28	29.2
	25	263	28	10.8	0	35	03.1
	26	265	00	57.3	0	41	28.1
	27	266	33	58.2	0	47	43.7
	28	268	07	13.9	-0	53	49.3
	29	269	40	44.8	0	59	44.5
	30	271	14	31.6	1	05	28.8
	31	272	48	34.9	1	11	01.4
	32	274	22	55.4	-1	16	22.0

MERCURY, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	17	26	57.12	-22	58	01.5	1.284 034	6.85	2.62	10	50	31
	1	17	33	14.79	23	10	08.8	1.296 140	6.78	2.59	10	52	54
	2	17	39	36.13	23	21	13.6	1.307 647	6.73	2.57	10	55	21
	3	17	46	00.89	23	31	13.7	1.318 565	6.67	2.55	10	57	51
	4	17	52	28.84	23	40	07.1	1.328 903	6.62	2.53	11	00	24
	5	17	58	59.76	23	47	51.7	1.338 670	6.57	2.51	11	02	60
	6	18	05	33.47	-23	54	26.0	1.347 875	6.52	2.49	11	05	39
	7	18	12	09.77	23	59	48.2	1.356 526	6.48	2.48	11	08	20
	8	18	18	48.49	24	03	56.9	1.364 630	6.44	2.46	11	11	03
	9	18	25	29.48	24	06	50.6	1.372 194	6.41	2.45	11	13	49
	10	18	32	12.59	24	08	28.1	1.379 222	6.38	2.44	11	16	37
	11	18	38	57.67	24	08	48.0	1.385 721	6.35	2.42	11	19	27
	12	18	45	44.58	-24	07	49.2	1.391 693	6.32	2.41	11	22	18
	13	18	52	33.20	24	05	30.7	1.397 143	6.29	2.40	11	25	11
	14	18	59	23.40	24	01	51.4	1.402 072	6.27	2.40	11	28	06
	15	19	06	15.06	23	56	50.4	1.406 481	6.25	2.39	11	31	02
	16	19	13	08.08	23	50	26.6	1.410 371	6.24	2.38	11	33	60
	17	19	20	02.33	23	42	39.3	1.413 741	6.22	2.38	11	36	58
	18	19	26	57.72	-23	33	27.5	1.416 588	6.21	2.37	11	39	58
	19	19	33	54.14	23	22	50.7	1.418 910	6.20	2.37	11	42	59
	20	19	40	51.48	23	10	48.0	1.420 703	6.19	2.37	11	46	00
	21	19	47	49.67	22	57	18.7	1.421 960	6.18	2.36	11	49	03
	22	19	54	48.59	22	42	22.3	1.422 675	6.18	2.36	11	52	06
	23	20	01	48.16	22	25	58.0	1.422 838	6.18	2.36	11	55	09
	24	20	08	48.28	-22	08	05.3	1.422 441	6.18	2.36	11	58	14
	25	20	15	48.88	21	48	43.8	1.421 470	6.19	2.36	12	01	18
	26	20	22	49.87	21	27	52.9	1.419 913	6.19	2.37	12	04	23
	27	20	29	51.15	21	05	32.3	1.417 755	6.20	2.37	12	07	28
	28	20	36	52.63	20	41	41.7	1.414 979	6.22	2.37	12	10	34
	29	20	43	54.23	20	16	20.8	1.411 567	6.23	2.38	12	13	39
	30	20	50	55.84	-19	49	29.5	1.407 497	6.25	2.39	12	16	45
	31	20	57	57.36	19	21	07.8	1.402 749	6.27	2.40	12	19	50
Feb.	1	21	04	58.66	18	51	15.8	1.397 297	6.29	2.40	12	22	55
	2	21	11	59.63	18	19	53.8	1.391 116	6.32	2.42	12	25	60
	3	21	19	00.12	17	47	02.3	1.384 178	6.35	2.43	12	29	04
	4	21	25	59.97	17	12	41.9	1.376 453	6.39	2.44	12	32	07
	5	21	32	59.00	-16	36	53.6	1.367 909	6.43	2.46	12	35	09
	6	21	39	57.00	15	59	38.6	1.358 513	6.47	2.47	12	38	10
	7	21	46	53.73	15	20	58.5	1.348 231	6.52	2.49	12	41	10
	8	21	53	48.90	14	40	55.4	1.337 027	6.58	2.51	12	44	08
	9	22	00	42.18	13	59	31.7	1.324 864	6.64	2.54	12	47	04
	10	22	07	33.18	13	16	50.7	1.311 708	6.70	2.56	12	49	57
	11	22	14	21.45	-12	32	56.1	1.297 524	6.78	2.59	12	52	48
	12	22	21	06.43	11	47	52.7	1.282 279	6.86	2.62	12	55	35
	13	22	27	47.49	11	01	46.0	1.265 944	6.95	2.65	12	58	17
	14	22	34	23.91	10	14	42.7	1.248 496	7.04	2.69	13	00	54
	15	22	40	54.82	-9	26	50.7	1.229 917	7.15	2.73	13	03	25

MERCURY, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	22	40	54.82	-9	26	50.7	1.229 917	7.15	2.73	13	03	25
	16	22	47	19.24	8	38	19.1	1.210 199	7.27	2.78	13	05	50
	17	22	53	36.03	7	49	18.5	1.189 346	7.39	2.83	13	08	05
	18	22	59	43.93	7	00	01.1	1.167 375	7.53	2.88	13	10	11
	19	23	05	41.51	6	10	40.7	1.144 319	7.69	2.94	13	12	06
	20	23	11	27.19	5	21	32.6	1.120 229	7.85	3.00	13	13	48
	21	23	16	59.23	-4	32	53.8	1.095 177	8.03	3.07	13	15	15
	22	23	22	15.80	3	45	02.9	1.069 256	8.22	3.14	13	16	26
	23	23	27	14.92	2	58	19.7	1.042 581	8.43	3.22	13	17	18
	24	23	31	54.55	2	13	05.2	1.015 290	8.66	3.31	13	17	50
	25	23	36	12.61	1	29	41.3	0.987 540	8.91	3.40	13	17	58
	26	23	40	07.02	0	48	30.3	0.959 506	9.17	3.50	13	17	42
	27	23	43	35.77	-0	09	54.7	0.931 378	9.44	3.61	13	16	59
	28	23	46	36.96	+0	25	43.1	0.903 358	9.73	3.72	13	15	48
Mar.	1	23	49	08.90	0	58	01.7	0.875 652	10.04	3.84	13	14	07
	2	23	51	10.12	1	26	40.7	0.848 470	10.36	3.96	13	11	54
	3	23	52	39.50	1	51	21.2	0.822 016	10.70	4.09	13	09	10
	4	23	53	36.27	2	11	46.4	0.796 492	11.04	4.22	13	05	52
	5	23	54	00.15	+2	27	42.3	0.772 084	11.39	4.35	13	02	02
	6	23	53	51.32	2	38	57.5	0.748 969	11.74	4.49	12	57	40
	7	23	53	10.57	2	45	24.8	0.727 306	12.09	4.62	12	52	47
	8	23	51	59.26	2	47	01.0	0.707 234	12.43	4.75	12	47	25
	9	23	50	19.38	2	43	47.7	0.688 874	12.77	4.88	12	41	36
	10	23	48	13.54	2	35	51.8	0.672 324	13.08	5.00	12	35	23
	11	23	45	44.93	+2	23	26.1	0.657 659	13.37	5.11	12	28	49
	12	23	42	57.28	2	06	49.0	0.644 931	13.64	5.21	12	21	59
	13	23	39	54.70	1	46	24.3	0.634 167	13.87	5.30	12	14	56
	14	23	36	41.65	1	22	40.9	0.625 372	14.06	5.37	12	07	45
	15	23	33	22.69	0	56	11.8	0.618 524	14.22	5.43	12	00	30
	16	23	30	02.41	+0	27	32.9	0.613 584	14.33	5.48	11	53	17
	17	23	26	45.21	-0	02	38.4	0.610 489	14.41	5.50	11	46	08
	18	23	23	35.21	0	33	44.5	0.609 163	14.44	5.52	11	39	08
	19	23	20	36.09	1	05	09.2	0.609 512	14.43	5.51	11	32	21
	20	23	17	51.06	1	36	18.7	0.611 435	14.38	5.50	11	25	49
	21	23	15	22.76	2	06	42.2	0.614 821	14.30	5.47	11	19	34
	22	23	13	13.28	2	35	53.3	0.619 558	14.19	5.42	11	13	39
	23	23	11	24.17	-3	03	29.4	0.625 529	14.06	5.37	11	08	05
	24	23	09	56.48	3	29	12.3	0.632 622	13.90	5.31	11	02	52
	25	23	08	50.79	3	52	47.8	0.640 726	13.73	5.24	10	58	00
	26	23	08	07.28	4	14	05.5	0.649 737	13.53	5.17	10	53	31
	27	23	07	45.83	4	32	58.1	0.659 555	13.33	5.09	10	49	24
	28	23	07	46.04	4	49	21.1	0.670 089	13.12	5.01	10	45	38
	29	23	08	07.31	-5	03	12.4	0.681 255	12.91	4.93	10	42	12
	30	23	08	48.90	5	14	31.5	0.692 975	12.69	4.85	10	39	06
	31	23	09	49.97	5	23	19.6	0.705 180	12.47	4.76	10	36	19
Apr.	1	23	11	09.59	5	29	39.0	0.717 807	12.25	4.68	10	33	51
	2	23	12	46.82	-5	33	32.5	0.730 800	12.03	4.60	10	31	39

MERCURY, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	23	11	09.59	-5	29	39.0	0.717 807	12.25	4.68	10	33	51
	2	23	12	46.82	5	33	32.5	0.730 800	12.03	4.60	10	31	39
	3	23	14	40.73	5	35	03.8	0.744 108	11.82	4.52	10	29	43
	4	23	16	50.35	5	34	16.9	0.757 689	11.61	4.43	10	28	03
	5	23	19	14.79	5	31	15.9	0.771 501	11.40	4.36	10	26	37
	6	23	21	53.16	5	26	05.2	0.785 512	11.20	4.28	10	25	25
	7	23	24	44.63	-5	18	49.1	0.799 691	11.00	4.20	10	24	25
	8	23	27	48.42	5	09	31.8	0.814 011	10.80	4.13	10	23	38
	9	23	31	03.79	4	58	17.5	0.828 449	10.62	4.06	10	23	01
	10	23	34	30.07	4	45	10.5	0.842 985	10.43	3.99	10	22	36
	11	23	38	06.63	4	30	14.5	0.857 602	10.25	3.92	10	22	20
	12	23	41	52.90	4	13	33.4	0.872 283	10.08	3.85	10	22	14
	13	23	45	48.36	-3	55	10.8	0.887 015	9.91	3.79	10	22	16
	14	23	49	52.54	3	35	10.3	0.901 786	9.75	3.73	10	22	28
	15	23	54	05.03	3	13	35.1	0.916 585	9.59	3.67	10	22	47
	16	23	58	25.46	2	50	28.4	0.931 403	9.44	3.61	10	23	14
	17	0	02	53.50	2	25	53.3	0.946 229	9.29	3.55	10	23	49
	18	0	07	28.88	1	59	52.6	0.961 056	9.15	3.50	10	24	31
	19	0	12	11.35	-1	32	29.1	0.975 875	9.01	3.44	10	25	20
	20	0	17	00.73	1	03	45.6	0.990 676	8.88	3.39	10	26	16
	21	0	21	56.84	0	33	44.6	1.005 453	8.75	3.34	10	27	18
	22	0	26	59.57	-0	02	28.7	1.020 195	8.62	3.29	10	28	27
	23	0	32	08.82	+0	29	59.6	1.034 893	8.50	3.25	10	29	43
	24	0	37	24.53	1	03	37.9	1.049 537	8.38	3.20	10	31	05
	25	0	42	46.67	+1	38	23.8	1.064 116	8.26	3.16	10	32	34
	26	0	48	15.24	2	14	14.7	1.078 616	8.15	3.12	10	34	08
	27	0	53	50.27	2	51	08.3	1.093 025	8.05	3.07	10	35	50
	28	0	59	31.83	3	29	02.0	1.107 326	7.94	3.03	10	37	38
	29	1	05	20.01	4	07	53.4	1.121 502	7.84	3.00	10	39	33
	30	1	11	14.93	4	47	39.9	1.135 533	7.74	2.96	10	41	34
May	1	1	17	16.72	+5	28	18.8	1.149 397	7.65	2.92	10	43	43
	2	1	23	25.56	6	09	47.2	1.163 067	7.56	2.89	10	45	59
	3	1	29	41.64	6	52	02.1	1.176 517	7.47	2.86	10	48	22
	4	1	36	05.16	7	35	00.3	1.189 713	7.39	2.82	10	50	52
	5	1	42	36.36	8	18	38.4	1.202 619	7.31	2.79	10	53	31
	6	1	49	15.48	9	02	52.5	1.215 194	7.24	2.76	10	56	17
	7	1	56	02.76	+9	47	38.6	1.227 395	7.16	2.74	10	59	12
	8	2	02	58.47	10	32	52.1	1.239 170	7.10	2.71	11	02	16
	9	2	10	02.85	11	18	28.0	1.250 465	7.03	2.69	11	05	28
	10	2	17	16.15	12	04	20.8	1.261 220	6.97	2.66	11	08	50
	11	2	24	38.58	12	50	24.3	1.271 368	6.92	2.64	11	12	20
	12	2	32	10.36	13	36	31.8	1.280 840	6.87	2.62	11	16	00
	13	2	39	51.62	+14	22	35.8	1.289 560	6.82	2.61	11	19	50
	14	2	47	42.48	15	08	28.0	1.297 449	6.78	2.59	11	23	50
	15	2	55	42.94	15	53	59.5	1.304 424	6.74	2.58	11	27	59
	16	3	03	52.96	16	39	00.6	1.310 404	6.71	2.56	11	32	18
	17	3	12	12.36	+17	23	20.6	1.315 303	6.69	2.55	11	36	46

MERCURY, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	3	12	12.36	+17	23	20.6	1.315 303	6.69	2.55	11	36	46
	18	3	20	40.85	18	06	48.5	1.319 042	6.67	2.55	11	41	23
	19	3	29	18.00	18	49	12.4	1.321 545	6.65	2.54	11	46	08
	20	3	38	03.23	19	30	20.3	1.322 743	6.65	2.54	11	51	02
	21	3	46	55.80	20	09	59.8	1.322 581	6.65	2.54	11	56	02
	22	3	55	54.85	20	47	58.8	1.321 014	6.66	2.54	12	01	09
	23	4	04	59.30	+21	24	05.1	1.318 014	6.67	2.55	12	06	20
	24	4	14	08.00	21	58	07.9	1.313 572	6.69	2.56	12	11	35
	25	4	23	19.68	22	29	56.8	1.307 697	6.72	2.57	12	16	52
	26	4	32	32.99	22	59	22.9	1.300 415	6.76	2.58	12	22	10
	27	4	41	46.52	23	26	18.7	1.291 774	6.81	2.60	12	27	28
	28	4	50	58.84	23	50	38.4	1.281 835	6.86	2.62	12	32	44
	29	5	00	08.56	+24	12	17.8	1.270 675	6.92	2.64	12	37	56
	30	5	09	14.31	24	31	14.5	1.258 380	6.99	2.67	12	43	04
	31	5	18	14.82	24	47	27.7	1.245 048	7.06	2.70	12	48	06
June	1	5	27	08.88	25	00	58.4	1.230 777	7.15	2.73	12	53	00
	2	5	35	55.40	25	11	48.6	1.215 671	7.23	2.76	12	57	47
	3	5	44	33.39	25	20	02.0	1.199 832	7.33	2.80	13	02	24
	4	5	53	01.97	+25	25	42.8	1.183 358	7.43	2.84	13	06	51
	5	6	01	20.39	25	28	56.4	1.166 345	7.54	2.88	13	11	08
	6	6	09	27.95	25	29	48.9	1.148 883	7.65	2.92	13	15	14
	7	6	17	24.09	25	28	26.5	1.131 055	7.78	2.97	13	19	07
	8	6	25	08.32	25	24	56.1	1.112 938	7.90	3.02	13	22	49
	9	6	32	40.21	25	19	24.8	1.094 602	8.03	3.07	13	26	17
	10	6	39	59.42	+25	11	59.6	1.076 112	8.17	3.12	13	29	33
	11	6	47	05.64	25	02	47.9	1.057 523	8.32	3.18	13	32	36
	12	6	53	58.63	24	51	56.8	1.038 888	8.46	3.23	13	35	25
	13	7	00	38.15	24	39	33.5	1.020 253	8.62	3.29	13	38	01
	14	7	07	04.02	24	25	45.1	1.001 660	8.78	3.35	13	40	22
	15	7	13	16.06	24	10	38.7	0.983 143	8.94	3.42	13	42	30
	16	7	19	14.11	+23	54	21.1	0.964 737	9.12	3.48	13	44	24
	17	7	24	58.02	23	36	59.1	0.946 470	9.29	3.55	13	46	03
	18	7	30	27.61	23	18	39.4	0.928 370	9.47	3.62	13	47	28
	19	7	35	42.74	22	59	28.5	0.910 459	9.66	3.69	13	48	38
	20	7	40	43.24	22	39	33.0	0.892 760	9.85	3.76	13	49	33
	21	7	45	28.91	22	18	59.1	0.875 294	10.05	3.84	13	50	14
	22	7	49	59.57	+21	57	53.3	0.858 079	10.25	3.92	13	50	39
	23	7	54	15.01	21	36	21.8	0.841 134	10.46	3.99	13	50	49
	24	7	58	14.99	21	14	30.7	0.824 477	10.67	4.08	13	50	44
	25	8	01	59.28	20	52	26.4	0.808 125	10.88	4.16	13	50	22
	26	8	05	27.61	20	30	15.0	0.792 097	11.10	4.24	13	49	45
	27	8	08	39.68	20	08	02.7	0.776 412	11.33	4.33	13	48	51
	28	8	11	35.21	+19	45	55.8	0.761 088	11.55	4.41	13	47	40
	29	8	14	13.89	19	24	00.6	0.746 147	11.79	4.50	13	46	13
	30	8	16	35.38	19	02	23.5	0.731 609	12.02	4.59	13	44	28
July	1	8	18	39.37	18	41	10.7	0.717 498	12.26	4.68	13	42	25
	2	8	20	25.52	+18	20	28.9	0.703 840	12.49	4.77	13	40	05

MERCURY, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	8	18	39.37	+18	41	10.7	0.717 498	12.26	4.68	13	42	25
	2	8	20	25.52	18	20	28.9	0.703 840	12.49	4.77	13	40	05
	3	8	21	53.53	18	00	24.4	0.690 661	12.73	4.86	13	37	26
	4	8	23	03.11	17	41	03.9	0.677 991	12.97	4.96	13	34	29
	5	8	23	54.01	17	22	33.8	0.665 862	13.21	5.05	13	31	13
	6	8	24	26.04	17	05	00.6	0.654 309	13.44	5.14	13	27	38
	7	8	24	39.07	+16	48	30.8	0.643 369	13.67	5.22	13	23	45
	8	8	24	33.09	16	33	10.6	0.633 082	13.89	5.31	13	19	32
	9	8	24	08.20	16	19	06.1	0.623 491	14.10	5.39	13	15	01
	10	8	23	24.65	16	06	23.0	0.614 641	14.31	5.47	13	10	12
	11	8	22	22.87	15	55	06.6	0.606 579	14.50	5.54	13	05	05
	12	8	21	03.48	15	45	21.8	0.599 356	14.67	5.61	12	59	41
	13	8	19	27.33	+15	37	12.7	0.593 021	14.83	5.67	12	54	01
	14	8	17	35.51	15	30	42.9	0.587 626	14.97	5.72	12	48	07
	15	8	15	29.38	15	25	54.8	0.583 223	15.08	5.76	12	41	58
	16	8	13	10.55	15	22	50.0	0.579 864	15.17	5.79	12	35	39
	17	8	10	40.91	15	21	28.9	0.577 597	15.23	5.82	12	29	10
	18	8	08	02.61	15	21	50.7	0.576 470	15.26	5.83	12	22	33
	19	8	05	18.04	+15	23	53.5	0.576 528	15.25	5.83	12	15	52
	20	8	02	29.78	15	27	34.2	0.577 809	15.22	5.82	12	09	08
	21	7	59	40.57	15	32	48.3	0.580 350	15.15	5.79	12	02	25
	22	7	56	53.28	15	39	30.5	0.584 180	15.05	5.75	11	55	45
	23	7	54	10.80	15	47	34.2	0.589 321	14.92	5.70	11	49	11
	24	7	51	36.03	15	56	52.1	0.595 790	14.76	5.64	11	42	46
	25	7	49	11.77	+16	07	16.0	0.603 598	14.57	5.57	11	36	33
	26	7	47	00.72	16	18	37.1	0.612 745	14.35	5.48	11	30	34
	27	7	45	05.40	16	30	46.1	0.623 229	14.11	5.39	11	24	52
	28	7	43	28.10	16	43	33.5	0.635 039	13.85	5.29	11	19	28
	29	7	42	10.89	16	56	49.2	0.648 156	13.57	5.18	11	14	26
	30	7	41	15.57	17	10	23.4	0.662 556	13.27	5.07	11	09	46
	31	7	40	43.67	+17	24	05.6	0.678 211	12.97	4.95	11	05	29
Aug.	1	7	40	36.46	17	37	45.6	0.695 084	12.65	4.83	11	01	38
	2	7	40	54.97	17	51	12.9	0.713 135	12.33	4.71	10	58	12
	3	7	41	39.96	18	04	17.2	0.732 315	12.01	4.59	10	55	13
	4	7	42	52.00	18	16	47.7	0.752 572	11.69	4.46	10	52	41
	5	7	44	31.44	18	28	33.9	0.773 846	11.36	4.34	10	50	37
	6	7	46	38.44	+18	39	24.9	0.796 071	11.05	4.22	10	48	60
	7	7	49	12.96	18	49	10.0	0.819 173	10.74	4.10	10	47	50
	8	7	52	14.82	18	57	38.3	0.843 070	10.43	3.99	10	47	08
	9	7	55	43.66	19	04	38.9	0.867 671	10.14	3.87	10	46	52
	10	7	59	38.95	19	10	01.0	0.892 877	9.85	3.76	10	47	02
	11	8	03	60.00	19	13	34.0	0.918 577	9.57	3.66	10	47	38
	12	8	08	45.96	+19	15	07.4	0.944 652	9.31	3.56	10	48	39
	13	8	13	55.80	19	14	31.5	0.970 973	9.06	3.46	10	50	02
	14	8	19	28.34	19	11	37.0	0.997 403	8.82	3.37	10	51	48
	15	8	25	22.20	19	06	15.8	1.023 796	8.59	3.28	10	53	55
	16	8	31	35.85	+18	58	20.7	1.050 002	8.38	3.20	10	56	21

MERCURY, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	8	31	35.85	+18	58	20.7	1.050 002	8.38	3.20	10	56	21
	17	8	38	07.62	18	47	46.1	1.075 870	8.17	3.12	10	59	04
	18	8	44	55.67	18	34	27.8	1.101 245	7.99	3.05	11	02	03
	19	8	51	58.07	18	18	23.8	1.125 981	7.81	2.98	11	05	15
	20	8	59	12.82	17	59	33.7	1.149 937	7.65	2.92	11	08	39
	21	9	06	37.86	17	37	59.2	1.172 984	7.50	2.86	11	12	12
	22	9	14	11.14	+17	13	43.9	1.195 009	7.36	2.81	11	15	52
	23	9	21	50.68	16	46	53.2	1.215 914	7.23	2.76	11	19	38
	24	9	29	34.57	16	17	34.3	1.235 623	7.12	2.72	11	23	27
	25	9	37	21.02	15	45	55.4	1.254 076	7.01	2.68	11	27	18
	26	9	45	08.41	15	12	06.1	1.271 236	6.92	2.64	11	31	10
	27	9	52	55.30	14	36	16.4	1.287 084	6.83	2.61	11	35	00
	28	10	00	40.41	+13	58	37.2	1.301 616	6.76	2.58	11	38	48
	29	10	08	22.66	13	19	19.1	1.314 844	6.69	2.56	11	42	33
	30	10	16	01.16	12	38	32.8	1.326 793	6.63	2.53	11	46	13
	31	10	23	35.19	11	56	28.9	1.337 496	6.58	2.51	11	49	49
Sept.	1	10	31	04.18	11	13	17.3	1.346 996	6.53	2.49	11	53	19
	2	10	38	27.73	10	29	07.5	1.355 339	6.49	2.48	11	56	44
	3	10	45	45.54	+9	44	08.4	1.362 576	6.45	2.47	12	00	02
	4	10	52	57.44	8	58	28.3	1.368 760	6.42	2.45	12	03	15
	5	11	00	03.33	8	12	14.7	1.373 942	6.40	2.45	12	06	22
	6	11	07	03.20	7	25	34.6	1.378 175	6.38	2.44	12	09	23
	7	11	13	57.09	6	38	34.5	1.381 510	6.37	2.43	12	12	17
	8	11	20	45.10	5	51	20.0	1.383 993	6.35	2.43	12	15	06
	9	11	27	27.38	+5	03	56.5	1.385 672	6.35	2.42	12	17	49
	10	11	34	04.07	4	16	28.6	1.386 589	6.34	2.42	12	20	27
	11	11	40	35.37	3	29	00.7	1.386 784	6.34	2.42	12	22	59
	12	11	47	01.49	2	41	36.7	1.386 294	6.34	2.42	12	25	26
	13	11	53	22.63	1	54	19.9	1.385 153	6.35	2.43	12	27	49
	14	11	59	39.01	1	07	13.8	1.383 391	6.36	2.43	12	30	06
	15	12	05	50.85	+0	20	21.0	1.381 039	6.37	2.43	12	32	20
	16	12	11	58.38	-0	26	15.7	1.378 119	6.38	2.44	12	34	29
	17	12	18	01.81	1	12	34.0	1.374 657	6.40	2.44	12	36	34
	18	12	24	01.35	1	58	31.5	1.370 672	6.42	2.45	12	38	35
	19	12	29	57.21	2	44	06.4	1.366 183	6.44	2.46	12	40	32
	20	12	35	49.57	3	29	16.6	1.361 205	6.46	2.47	12	42	27
	21	12	41	38.63	-4	14	00.5	1.355 753	6.49	2.48	12	44	18
	22	12	47	24.55	4	58	16.3	1.349 839	6.51	2.49	12	46	05
	23	12	53	07.50	5	42	02.5	1.343 474	6.55	2.50	12	47	50
	24	12	58	47.63	6	25	17.6	1.336 666	6.58	2.51	12	49	33
	25	13	04	25.06	7	07	60.0	1.329 424	6.62	2.53	12	51	12
	26	13	09	59.93	7	50	08.4	1.321 753	6.65	2.54	12	52	49
	27	13	15	32.34	-8	31	41.3	1.313 658	6.69	2.56	12	54	24
	28	13	21	02.37	9	12	37.5	1.305 143	6.74	2.57	12	55	56
	29	13	26	30.10	9	52	55.5	1.296 211	6.78	2.59	12	57	26
	30	13	31	55.60	10	32	33.9	1.286 865	6.83	2.61	12	58	54
Oct.	1	13	37	18.89	-11	11	31.4	1.277 105	6.89	2.63	13	00	20

MERCURY, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	13	37	18.89	-11	11	31.4	1.277 105	6.89	2.63	13	00	20
	2	13	42	40.00	11	49	46.6	1.266 932	6.94	2.65	13	01	43
	3	13	47	58.92	12	27	18.0	1.256 347	7.00	2.67	13	03	05
	4	13	53	15.62	13	04	04.1	1.245 348	7.06	2.70	13	04	24
	5	13	58	30.05	13	40	03.5	1.233 936	7.13	2.72	13	05	40
	6	14	03	42.12	14	15	14.4	1.222 109	7.20	2.75	13	06	55
	7	14	08	51.73	-14	49	35.3	1.209 865	7.27	2.78	13	08	06
	8	14	13	58.74	15	23	04.3	1.197 203	7.35	2.81	13	09	15
	9	14	19	02.96	15	55	39.8	1.184 121	7.43	2.84	13	10	21
	10	14	24	04.18	16	27	19.6	1.170 617	7.51	2.87	13	11	24
	11	14	29	02.14	16	58	01.8	1.156 691	7.60	2.90	13	12	24
	12	14	33	56.52	17	27	44.2	1.142 341	7.70	2.94	13	13	20
	13	14	38	46.95	-17	56	24.3	1.127 567	7.80	2.98	13	14	11
	14	14	43	33.02	18	23	59.9	1.112 369	7.91	3.02	13	14	58
	15	14	48	14.21	18	50	28.0	1.096 749	8.02	3.06	13	15	40
	16	14	52	49.97	19	15	45.8	1.080 711	8.14	3.11	13	16	16
	17	14	57	19.64	19	39	50.1	1.064 258	8.26	3.16	13	16	45
	18	15	01	42.46	20	02	37.5	1.047 398	8.40	3.21	13	17	07
	19	15	05	57.58	-20	24	04.1	1.030 141	8.54	3.26	13	17	21
	20	15	10	04.02	20	44	05.9	1.012 500	8.69	3.32	13	17	26
	21	15	14	00.69	21	02	38.2	0.994 492	8.84	3.38	13	17	20
	22	15	17	46.35	21	19	36.0	0.976 140	9.01	3.44	13	17	02
	23	15	21	19.59	21	34	53.6	0.957 472	9.18	3.51	13	16	31
	24	15	24	38.87	21	48	24.7	0.938 522	9.37	3.58	13	15	46
	25	15	27	42.46	-22	00	02.4	0.919 336	9.57	3.65	13	14	43
	26	15	30	28.45	22	09	38.9	0.899 965	9.77	3.73	13	13	22
	27	15	32	54.76	22	17	05.5	0.880 477	9.99	3.82	13	11	40
	28	15	34	59.13	22	22	12.4	0.860 950	10.21	3.90	13	09	35
	29	15	36	39.17	22	24	48.9	0.841 479	10.45	3.99	13	07	05
	30	15	37	52.35	22	24	43.1	0.822 179	10.70	4.09	13	04	06
	31	15	38	36.13	-22	21	42.4	0.803 183	10.95	4.18	13	00	37
Nov.	1	15	38	47.98	22	15	33.0	0.784 648	11.21	4.28	12	56	34
	2	15	38	25.59	22	06	01.0	0.766 755	11.47	4.38	12	51	57
	3	15	37	26.98	21	52	52.8	0.749 710	11.73	4.48	12	46	43
	4	15	35	50.76	21	35	55.9	0.733 746	11.99	4.58	12	40	52
	5	15	33	36.38	21	15	00.9	0.719 118	12.23	4.67	12	34	23
	6	15	30	44.41	-20	50	03.3	0.706 100	12.45	4.76	12	27	17
	7	15	27	16.82	20	21	05.5	0.694 977	12.65	4.83	12	19	39
	8	15	23	17.20	19	48	19.8	0.686 037	12.82	4.90	12	11	31
	9	15	18	50.89	19	12	10.4	0.679 554	12.94	4.94	12	03	00
	10	15	14	04.91	18	33	15.0	0.675 772	13.01	4.97	11	54	14
	11	15	09	07.72	17	52	24.7	0.674 891	13.03	4.98	11	45	22
	12	15	04	08.77	-17	10	42.3	0.677 044	12.99	4.96	11	36	32
	13	14	59	17.90	16	29	18.6	0.682 291	12.89	4.92	11	27	55
	14	14	54	44.59	15	49	26.9	0.690 608	12.73	4.87	11	19	40
	15	14	50	37.39	15	12	17.2	0.701 888	12.53	4.79	11	11	53
	16	14	47	03.35	-14	38	50.8	0.715 946	12.28	4.69	11	04	42

MERCURY, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	14	47	03.35	-14	38	50.8	0.715 946	12.28	4.69	11	04	42
	17	14	44	07.76	14	09	56.2	0.732 535	12.01	4.59	10	58	10
	18	14	41	54.00	13	46	06.6	0.751 360	11.70	4.47	10	52	21
	19	14	40	23.69	13	27	40.2	0.772 095	11.39	4.35	10	47	15
	20	14	39	36.90	13	14	41.2	0.794 406	11.07	4.23	10	42	51
	21	14	39	32.46	13	07	02.0	0.817 957	10.75	4.11	10	39	09
	22	14	40	08.30	-13	04	26.3	0.842 433	10.44	3.99	10	36	06
	23	14	41	21.76	13	06	31.3	0.867 539	10.14	3.87	10	33	38
	24	14	43	09.81	13	12	50.7	0.893 010	9.85	3.76	10	31	44
	25	14	45	29.32	13	22	56.2	0.918 615	9.57	3.66	10	30	20
	26	14	48	17.15	13	36	19.3	0.944 154	9.31	3.56	10	29	23
	27	14	51	30.33	13	52	32.5	0.969 459	9.07	3.47	10	28	50
	28	14	55	06.06	-14	11	09.6	0.994 390	8.84	3.38	10	28	38
	29	14	59	01.78	14	31	46.3	1.018 836	8.63	3.30	10	28	45
	30	15	03	15.19	14	54	00.7	1.042 707	8.43	3.22	10	29	09
Dec.	1	15	07	44.24	15	17	32.8	1.065 935	8.25	3.15	10	29	48
	2	15	12	27.12	15	42	04.8	1.088 467	8.08	3.09	10	30	40
	3	15	17	22.25	16	07	21.0	1.110 267	7.92	3.03	10	31	43
	4	15	22	28.23	-16	33	07.4	1.131 308	7.77	2.97	10	32	57
	5	15	27	43.88	16	59	11.6	1.151 576	7.64	2.92	10	34	20
	6	15	33	08.15	17	25	23.0	1.171 063	7.51	2.87	10	35	52
	7	15	38	40.15	17	51	31.9	1.189 766	7.39	2.82	10	37	30
	8	15	44	19.11	18	17	29.9	1.207 688	7.28	2.78	10	39	16
	9	15	50	04.37	18	43	09.9	1.224 838	7.18	2.74	10	41	07
	10	15	55	55.35	-19	08	25.2	1.241 223	7.09	2.71	10	43	04
	11	16	01	51.56	19	33	10.1	1.256 857	7.00	2.67	10	45	06
	12	16	07	52.59	19	57	19.6	1.271 751	6.91	2.64	10	47	13
	13	16	13	58.06	20	20	49.0	1.285 921	6.84	2.61	10	49	24
	14	16	20	07.66	20	43	34.5	1.299 379	6.77	2.59	10	51	39
	15	16	26	21.11	21	05	32.3	1.312 141	6.70	2.56	10	53	58
	16	16	32	38.17	-21	26	39.2	1.324 221	6.64	2.54	10	56	20
	17	16	38	58.62	21	46	52.2	1.335 633	6.58	2.52	10	58	46
	18	16	45	22.29	22	06	08.6	1.346 390	6.53	2.50	11	01	14
	19	16	51	49.00	22	24	25.9	1.356 505	6.48	2.48	11	03	46
	20	16	58	18.61	22	41	41.7	1.365 990	6.44	2.46	11	06	21
	21	17	04	50.98	22	57	54.1	1.374 857	6.40	2.44	11	08	58
	22	17	11	25.98	-23	13	01.0	1.383 117	6.36	2.43	11	11	38
	23	17	18	03.49	23	27	00.5	1.390 778	6.32	2.42	11	14	21
	24	17	24	43.42	23	39	51.0	1.397 851	6.29	2.40	11	17	05
	25	17	31	25.64	23	51	30.9	1.404 343	6.26	2.39	11	19	52
	26	17	38	10.05	24	01	58.4	1.410 261	6.24	2.38	11	22	41
	27	17	44	56.55	24	11	12.3	1.415 613	6.21	2.37	11	25	33
	28	17	51	45.04	-24	19	11.1	1.420 403	6.19	2.37	11	28	26
	29	17	58	35.43	24	25	53.3	1.424 637	6.17	2.36	11	31	21
	30	18	05	27.61	24	31	17.8	1.428 316	6.16	2.35	11	34	18
	31	18	12	21.48	24	35	23.3	1.431 445	6.14	2.35	11	37	16
	32	18	19	16.96	-24	38	08.5	1.434 024	6.13	2.34	11	40	16

VENUS, 2019

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ' "	° ' "			° ' "	° ' "	
Jan. 1	140 18 06.1	+3 02 15.8	0.718 5092	Apr. 3	287 53 51.1	-1 45 08.5	0.727 7777
3	143 33 09.3	3 07 07.5	0.718 5576	5	291 03 35.9	1 54 36.6	0.727 8811
5	146 48 12.3	3 11 23.1	0.718 6210	7	294 13 19.7	2 03 43.7	0.727 9704
7	150 03 14.6	3 15 01.7	0.718 6994	9	297 23 03.1	2 12 28.1	0.728 0454
9	153 18 15.3	3 18 02.7	0.718 7924	11	300 32 46.6	2 20 48.2	0.728 1058
11	156 33 13.8	3 20 25.5	0.718 8997	13	303 42 30.6	2 28 42.5	0.728 1515
13	159 48 09.5	+3 22 09.8	0.719 0210	15	306 52 15.6	-2 36 09.6	0.728 1823
15	163 03 01.5	3 23 15.1	0.719 1558	17	310 02 02.1	2 43 08.2	0.728 1981
17	166 17 49.2	3 23 41.3	0.719 3039	19	313 11 50.4	2 49 37.0	0.728 1989
19	169 32 32.0	3 23 28.4	0.719 4646	21	316 21 40.9	2 55 34.9	0.728 1846
21	172 47 09.1	3 22 36.5	0.719 6374	23	319 31 34.1	3 01 00.7	0.728 1553
23	176 01 39.9	3 21 05.8	0.719 8219	25	322 41 30.2	3 05 53.5	0.728 1112
25	179 16 03.9	+3 18 56.6	0.720 0173	27	325 51 29.6	-3 10 12.3	0.728 0522
27	182 30 20.3	3 16 09.5	0.720 2231	29	329 01 32.5	3 13 56.3	0.727 9786
29	185 44 28.8	3 12 45.0	0.720 4386	May 1	332 11 39.3	3 17 05.0	0.727 8907
31	188 58 28.8	3 08 43.8	0.720 6632	3	335 21 50.1	3 19 37.6	0.727 7887
Feb. 2	192 12 19.8	3 04 06.9	0.720 8960	5	338 32 05.1	3 21 33.6	0.727 6728
4	195 26 01.3	2 58 55.2	0.721 1364	7	341 42 24.7	3 22 52.7	0.727 5435
6	198 39 33.0	+2 53 09.6	0.721 3836	9	344 52 48.9	-3 23 34.6	0.727 4011
8	201 52 54.7	2 46 51.6	0.721 6368	11	348 03 18.0	3 23 39.2	0.727 2460
10	205 06 06.0	2 40 02.2	0.721 8953	13	351 13 52.0	3 23 06.3	0.727 0788
12	208 19 06.7	2 32 42.8	0.722 1581	15	354 24 31.2	3 21 56.0	0.726 9000
14	211 31 56.7	2 24 55.0	0.722 4245	17	357 35 15.6	3 20 08.5	0.726 7100
16	214 44 35.8	2 16 40.3	0.722 6936	19	0 46 05.3	3 17 44.1	0.726 5094
18	217 57 04.0	+2 08 00.2	0.722 9646	21	3 57 00.4	-3 14 43.0	0.726 2990
20	221 09 21.3	1 58 56.6	0.723 2366	23	7 08 01.1	3 11 05.9	0.726 0792
22	224 21 27.9	1 49 31.0	0.723 5089	25	10 19 07.4	3 06 53.3	0.725 8509
24	227 33 23.7	1 39 45.4	0.723 7804	27	13 30 19.4	3 02 05.9	0.725 6146
26	230 45 08.9	1 29 41.7	0.724 0505	29	16 41 37.2	2 56 44.6	0.725 3711
28	233 56 43.9	1 19 21.6	0.724 3182	31	19 53 01.0	2 50 50.2	0.725 1212
Mar. 2	237 08 08.8	+1 08 47.3	0.724 5827	June 2	23 04 30.6	-2 44 23.9	0.724 8656
4	240 19 23.9	0 58 00.6	0.724 8433	4	26 16 06.3	2 37 26.8	0.724 6052
6	243 30 29.7	0 47 03.7	0.725 0990	6	29 27 48.1	2 29 60.0	0.724 3406
8	246 41 26.4	0 35 58.5	0.725 3492	8	32 39 36.2	2 22 04.9	0.724 0728
10	249 52 14.6	0 24 47.1	0.725 5930	10	35 51 30.6	2 13 42.9	0.723 8026
12	253 02 54.7	0 13 31.5	0.725 8297	12	39 03 31.3	2 04 55.6	0.723 5309
14	256 13 27.1	+0 02 13.9	0.726 0586	14	42 15 38.5	-1 55 44.5	0.723 2584
16	259 23 52.4	-0 09 03.7	0.726 2789	16	45 27 52.3	1 46 11.3	0.722 9860
18	262 34 11.1	0 20 19.2	0.726 4901	18	48 40 12.8	1 36 17.7	0.722 7146
20	265 44 23.8	0 31 30.6	0.726 6914	20	51 52 40.0	1 26 05.7	0.722 4450
22	268 54 31.0	0 42 35.8	0.726 8823	22	55 05 14.1	1 15 36.9	0.722 1782
24	272 04 33.2	0 53 33.0	0.727 0621	24	58 17 55.1	1 04 53.5	0.721 9148
26	275 14 31.2	-1 04 19.9	0.727 2303	26	61 30 43.1	-0 53 57.3	0.721 6558
28	278 24 25.3	1 14 54.9	0.727 3864	28	64 43 38.1	0 42 50.5	0.721 4020
30	281 34 16.4	1 25 15.8	0.727 5300	30	67 56 40.3	0 31 35.2	0.721 1542
Apr. 1	284 44 04.7	1 35 21.0	0.727 6605	July 2	71 09 49.6	0 20 13.4	0.720 9131
3	287 53 51.1	-1 45 08.5	0.727 7777	4	74 23 06.1	-0 08 47.3	0.720 6796

VENUS, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector	Date		Heliocentric Longitude			Heliocentric Latitude			Radius Vector
		°	'	"	°	'	"				°	'	"	°	'	"	
July	2	71	09	49.6	-0	20	13.4	0.720 9131	Oct.	2	220	02	36.7	+2	02	09.1	0.723 1493
	4	74	23	06.1	-0	08	47.3	0.720 6796		4	223	14	46.7	1	52	51.0	0.723 4214
	6	77	36	29.8	+0	02	40.9	0.720 4544		6	226	26	46.0	1	43	12.2	0.723 6932
	8	80	50	00.7	0	14	09.0	0.720 2382		8	229	38	34.8	1	33	14.6	0.723 9637
	10	84	03	38.7	0	25	34.8	0.720 0317		10	232	50	13.1	1	23	00.0	0.724 2322
	12	87	17	23.8	0	36	56.1	0.719 8356		12	236	01	41.2	1	12	30.5	0.724 4977
	14	90	31	15.8	+0	48	10.7	0.719 6505		14	239	12	59.5	+1	01	47.9	0.724 7596
	16	93	45	14.7	0	59	16.5	0.719 4770		16	242	24	08.3	0	50	54.3	0.725 0169
	18	96	59	20.4	1	10	11.3	0.719 3156		18	245	35	08.0	0	39	51.8	0.725 2688
	20	100	13	32.5	1	20	52.8	0.719 1669		20	248	45	58.9	0	28	42.3	0.725 5147
	22	103	27	50.9	1	31	19.2	0.719 0313		22	251	56	41.6	0	17	28.0	0.725 7537
	24	106	42	15.4	1	41	28.3	0.718 9094		24	255	07	16.5	+0	06	10.9	0.725 9852
	26	109	56	45.6	+1	51	18.2	0.718 8014		26	258	17	44.1	-0	05	06.9	0.726 2083
	28	113	11	21.2	2	00	46.8	0.718 7078		28	261	28	04.9	0	16	23.3	0.726 4225
	30	116	26	01.8	2	09	52.4	0.718 6288		30	264	38	19.5	0	27	36.4	0.726 6270
Aug.	1	119	40	47.0	2	18	33.0	0.718 5648	Nov.	1	267	48	28.4	0	38	44.0	0.726 8213
	3	122	55	36.4	2	26	47.1	0.718 5158		3	270	58	32.2	0	49	44.2	0.727 0047
	5	126	10	29.4	2	34	33.1	0.718 4821		5	274	08	31.5	1	00	34.9	0.727 1768
	7	129	25	25.6	+2	41	49.3	0.718 4637		7	277	18	26.8	-1	11	14.3	0.727 3369
	9	132	40	24.4	2	48	34.3	0.718 4608		9	280	28	18.8	1	21	40.4	0.727 4847
	11	135	55	25.1	2	54	46.9	0.718 4733		11	283	38	07.9	1	31	51.3	0.727 6195
	13	139	10	27.3	3	00	25.7	0.718 5012		13	286	47	54.8	1	41	45.1	0.727 7412
	15	142	25	30.2	3	05	29.7	0.718 5445		15	289	57	40.0	1	51	20.2	0.727 8492
	17	145	40	33.3	3	09	58.0	0.718 6028		17	293	07	24.1	2	00	34.8	0.727 9432
	19	148	55	35.7	+3	13	49.6	0.718 6762		19	296	17	07.6	-2	09	27.3	0.728 0230
	21	152	10	36.9	3	17	03.8	0.718 7643		21	299	26	50.9	2	17	56.1	0.728 0883
	23	155	25	36.1	3	19	40.1	0.718 8668		23	302	36	34.7	2	25	59.6	0.728 1390
	25	158	40	32.7	3	21	37.8	0.718 9834		25	305	46	19.2	2	33	36.4	0.728 1748
	27	161	55	25.9	3	22	56.7	0.719 1137		27	308	56	05.1	2	40	45.1	0.728 1957
	29	165	10	14.9	3	23	36.6	0.719 2574		29	312	05	52.7	2	47	24.5	0.728 2015
	31	168	24	59.3	+3	23	37.4	0.719 4139	Dec.	1	315	15	42.4	-2	53	33.3	0.728 1924
Sept.	2	171	39	38.3	3	22	59.0	0.719 5827		3	318	25	34.6	2	59	10.4	0.728 1682
	4	174	54	11.2	3	21	41.8	0.719 7633		5	321	35	29.6	3	04	14.8	0.728 1291
	6	178	08	37.4	3	19	46.0	0.719 9551		7	324	45	27.8	3	08	45.6	0.728 0751
	8	181	22	56.4	3	17	12.1	0.720 1575		9	327	55	29.4	3	12	41.9	0.728 0066
	10	184	37	07.5	3	14	00.5	0.720 3698		11	331	05	34.8	3	16	03.0	0.727 9235
	12	187	51	10.3	+3	10	12.2	0.720 5914		13	334	15	44.1	-3	18	48.3	0.727 8263
	14	191	05	04.2	3	05	47.6	0.720 8215		15	337	25	57.7	3	20	57.2	0.727 7151
	16	194	18	48.9	3	00	47.9	0.721 0594		17	340	36	15.7	3	22	29.3	0.727 5903
	18	197	32	23.9	2	55	14.1	0.721 3044		19	343	46	38.2	3	23	24.2	0.727 4524
	20	200	45	48.9	2	49	07.3	0.721 5556		21	346	57	05.6	3	23	41.9	0.727 3016
	22	203	59	03.6	2	42	28.6	0.721 8124		23	350	07	37.8	3	23	22.0	0.727 1385
	24	207	12	07.8	+2	35	19.6	0.722 0737		25	353	18	15.2	-3	22	24.8	0.726 9635
	26	210	25	01.3	2	27	41.6	0.722 3390		27	356	28	57.7	3	20	50.3	0.726 7772
	28	213	37	44.0	2	19	36.1	0.722 6072		29	359	39	45.5	3	18	38.7	0.726 5802
	30	216	50	15.8	2	11	04.7	0.722 8776		31	2	50	38.7	3	15	50.4	0.726 3730
Oct.	2	220	02	36.7	+2	02	09.1	0.723 1493		33	6	01	37.5	-3	12	25.8	0.726 1563

VENUS, 2019
GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	0	232	31	00.4	+3	25	51.1	Feb.	15	282	44	40.1	+1	44	48.2
	1	233	29	38.0	3	26	23.7		16	283	54	28.7	1	40	58.2
	2	234	28	44.8	3	26	45.7		17	285	04	23.3	1	37	07.0
	3	235	28	19.6	3	26	57.3		18	286	14	23.8	1	33	14.7
	4	236	28	21.4	3	26	58.8		19	287	24	30.0	1	29	21.4
	5	237	28	49.1	3	26	50.3		20	288	34	41.9	1	25	27.4
	6	238	29	41.6	+3	26	32.2		21	289	44	59.4	+1	21	32.8
	7	239	30	58.0	3	26	04.7		22	290	55	22.2	1	17	37.7
	8	240	32	37.5	3	25	28.0		23	292	05	50.4	1	13	42.2
	9	241	34	39.1	3	24	42.5		24	293	16	23.8	1	09	46.6
	10	242	37	02.1	3	23	48.3		25	294	27	02.2	1	05	51.0
	11	243	39	45.6	3	22	45.6		26	295	37	45.4	1	01	55.6
	12	244	42	49.1	+3	21	34.8		27	296	48	33.3	+0	58	00.4
	13	245	46	11.7	3	20	16.0		28	297	59	25.7	0	54	05.7
	14	246	49	52.9	3	18	49.4	Mar.	1	299	10	22.3	0	50	11.6
	15	247	53	52.1	3	17	15.3		2	300	21	23.0	0	46	18.2
	16	248	58	08.7	3	15	33.9		3	301	32	27.7	0	42	25.7
	17	250	02	42.3	3	13	45.4		4	302	43	36.0	0	38	34.3
	18	251	07	32.2	+3	11	50.0		5	303	54	47.9	+0	34	44.0
	19	252	12	38.0	3	09	47.9		6	305	06	03.3	0	30	55.0
	20	253	17	59.4	3	07	39.3		7	306	17	21.9	0	27	07.4
	21	254	23	35.7	3	05	24.5		8	307	28	43.6	0	23	21.4
	22	255	29	26.6	3	03	03.6		9	308	40	08.4	0	19	37.1
	23	256	35	31.6	3	00	36.7		10	309	51	36.1	0	15	54.6
	24	257	41	50.2	+2	58	04.2		11	311	03	06.7	+0	12	14.1
	25	258	48	22.1	2	55	26.3		12	312	14	40.0	0	08	35.6
	26	259	55	06.9	2	52	43.0		13	313	26	15.9	0	04	59.3
	27	261	02	04.0	2	49	54.6		14	314	37	54.5	+0	01	25.3
	28	262	09	13.1	2	47	01.4		15	315	49	35.5	-0	02	06.4
	29	263	16	33.7	2	44	03.5		16	317	01	19.0	0	05	35.5
	30	264	24	05.4	+2	41	01.1		17	318	13	04.8	-0	09	02.1
	31	265	31	47.7	2	37	54.4		18	319	24	53.0	0	12	25.9
Feb.	1	266	39	40.3	2	34	43.6		19	320	36	43.4	0	15	47.0
	2	267	47	42.7	2	31	28.9		20	321	48	36.1	0	19	05.2
	3	268	55	54.5	2	28	10.5		21	323	00	31.1	0	22	20.4
	4	270	04	15.4	2	24	48.6		22	324	12	28.3	0	25	32.6
	5	271	12	45.1	+2	21	23.4		23	325	24	27.9	-0	28	41.6
	6	272	21	23.1	2	17	55.0		24	326	36	29.8	0	31	47.3
	7	273	30	09.2	2	14	23.7		25	327	48	33.8	0	34	49.8
	8	274	39	03.2	2	10	49.6		26	329	00	40.1	0	37	48.8
	9	275	48	04.7	2	07	12.9		27	330	12	48.4	0	40	44.3
	10	276	57	13.5	2	03	33.8		28	331	24	58.6	0	43	36.3
	11	278	06	29.4	+1	59	52.5		29	332	37	10.8	-0	46	24.6
	12	279	15	52.2	1	56	09.1		30	333	49	24.7	0	49	09.1
	13	280	25	21.7	1	52	23.8		31	335	01	40.2	0	51	49.9
	14	281	34	57.7	1	48	36.8	Apr.	1	336	13	57.4	0	54	26.7
	15	282	44	40.1	+1	44	48.2		2	337	26	16.1	-0	56	59.7

VENUS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	336	13	57.4	-0	54	26.7	May	17	31	56	02.6	-1	35	24.0
	2	337	26	16.1	0	56	59.7		18	33	08	55.7	1	34	34.0
	3	338	38	36.2	0	59	28.6		19	34	21	49.5	1	33	40.2
	4	339	50	57.6	1	01	53.4		20	35	34	43.8	1	32	42.5
	5	341	03	20.3	1	04	14.1		21	36	47	38.8	1	31	41.1
	6	342	15	44.2	1	06	30.6		22	38	00	34.4	1	30	35.9
	7	343	28	09.3	-1	08	42.9		23	39	13	30.6	-1	29	27.0
	8	344	40	35.5	1	10	51.0		24	40	26	27.5	1	28	14.6
	9	345	53	02.7	1	12	54.7		25	41	39	25.0	1	26	58.6
	10	347	05	31.0	1	14	54.0		26	42	52	23.2	1	25	39.1
	11	348	18	00.1	1	16	48.9		27	44	05	21.9	1	24	16.3
	12	349	30	30.1	1	18	39.4		28	45	18	21.3	1	22	50.1
	13	350	43	01.0	-1	20	25.5		29	46	31	21.4	-1	21	20.6
	14	351	55	32.6	1	22	07.0		30	47	44	22.1	1	19	48.0
	15	353	08	05.0	1	23	44.1		31	48	57	23.4	1	18	12.2
	16	354	20	38.2	1	25	16.6	June	1	50	10	25.4	1	16	33.5
	17	355	33	12.2	1	26	44.6		2	51	23	28.0	1	14	51.7
	18	356	45	47.1	1	28	08.0		3	52	36	31.2	1	13	07.2
	19	357	58	22.9	-1	29	26.8		4	53	49	35.0	-1	11	19.8
	20	359	10	59.6	1	30	41.0		5	55	02	39.4	1	09	29.7
	21	0	23	37.3	1	31	50.7		6	56	15	44.2	1	07	37.1
	22	1	36	16.0	1	32	55.7		7	57	28	49.5	1	05	41.9
	23	2	48	55.7	1	33	56.1		8	58	41	55.1	1	03	44.3
	24	4	01	36.3	1	34	51.8		9	59	55	01.2	1	01	44.4
	25	5	14	17.8	-1	35	43.0		10	61	08	07.7	-0	59	42.3
	26	6	27	00.2	1	36	29.5		11	62	21	14.6	0	57	38.0
	27	7	39	43.4	1	37	11.3		12	63	34	22.0	0	55	31.6
	28	8	52	27.3	1	37	48.5		13	64	47	30.0	0	53	23.4
	29	10	05	12.0	1	38	21.2		14	66	00	38.6	0	51	13.2
	30	11	17	57.4	1	38	49.2		15	67	13	47.9	0	49	01.3
May	1	12	30	43.4	-1	39	12.6		16	68	26	57.9	-0	46	47.7
	2	13	43	30.1	1	39	31.4		17	69	40	08.7	0	44	32.6
	3	14	56	17.4	1	39	45.6		18	70	53	20.3	0	42	15.9
	4	16	09	05.2	1	39	55.4		19	72	06	32.7	0	39	57.9
	5	17	21	53.5	1	40	00.6		20	73	19	46.0	0	37	38.6
	6	18	34	42.4	1	40	01.3		21	74	33	00.2	0	35	18.0
	7	19	47	31.7	-1	39	57.5		22	75	46	15.3	-0	32	56.4
	8	21	00	21.4	1	39	49.4		23	76	59	31.3	0	30	33.7
	9	22	13	11.5	1	39	36.8		24	78	12	48.2	0	28	10.2
	10	23	26	01.9	1	39	19.9		25	79	26	06.2	0	25	45.8
	11	24	38	52.5	1	38	58.7		26	80	39	25.1	0	23	20.7
	12	25	51	43.4	1	38	33.3		27	81	52	45.1	0	20	55.0
	13	27	04	34.6	-1	38	03.6		28	83	06	06.1	-0	18	28.8
	14	28	17	26.0	1	37	29.8		29	84	19	28.2	0	16	02.2
	15	29	30	17.8	1	36	51.9		30	85	32	51.3	0	13	35.2
	16	30	43	09.9	1	36	09.9	July	1	86	46	15.5	0	11	08.1
	17	31	56	02.6	-1	35	24.0		2	87	59	40.6	-0	08	40.9

VENUS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	86	46	15.5	-0	11	08.1	Aug.	16	143	20	42.6	+1	17	56.0
	2	87	59	40.6	0	08	40.9		17	144	34	53.4	1	18	50.7
	3	89	13	06.8	0	06	13.6		18	145	49	05.2	1	19	41.8
	4	90	26	33.8	0	03	46.5		19	147	03	17.8	1	20	29.3
	5	91	40	01.7	-0	01	19.6		20	148	17	31.4	1	21	13.2
	6	92	53	30.4	+0	01	07.0		21	149	31	45.9	1	21	53.3
	7	94	06	59.9	+0	03	33.2		22	150	46	01.5	+1	22	29.8
	8	95	20	30.2	0	05	58.8		23	152	00	18.0	1	23	02.4
	9	96	34	01.2	0	08	23.9		24	153	14	35.5	1	23	31.3
	10	97	47	33.2	0	10	48.2		25	154	28	54.1	1	23	56.5
	11	99	01	06.0	0	13	11.6		26	155	43	13.6	1	24	17.7
	12	100	14	39.7	0	15	34.2		27	156	57	34.0	1	24	35.2
	13	101	28	14.4	+0	17	55.8		28	158	11	55.2	+1	24	48.8
	14	102	41	50.1	0	20	16.2		29	159	26	17.3	1	24	58.5
	15	103	55	26.9	0	22	35.4		30	160	40	40.1	1	25	04.3
	16	105	09	04.6	0	24	53.4		31	161	55	03.5	1	25	06.2
	17	106	22	43.4	0	27	10.0	Sept.	1	163	09	27.6	1	25	04.1
	18	107	36	23.2	0	29	25.1		2	164	23	52.2	1	24	58.2
	19	108	50	04.2	+0	31	38.6		3	165	38	17.4	+1	24	48.3
	20	110	03	46.2	0	33	50.5		4	166	52	43.1	1	24	34.5
	21	111	17	29.4	0	36	00.7		5	168	07	09.3	1	24	16.8
	22	112	31	13.8	0	38	09.0		6	169	21	35.9	1	23	55.2
	23	113	44	59.4	0	40	15.5		7	170	36	02.9	1	23	29.7
	24	114	58	46.2	0	42	19.9		8	171	50	30.3	1	23	00.3
	25	116	12	34.2	+0	44	22.3		9	173	04	58.1	+1	22	27.1
	26	117	26	23.5	0	46	22.6		10	174	19	26.2	1	21	50.0
	27	118	40	14.1	0	48	20.6		11	175	33	54.6	1	21	09.1
	28	119	54	06.0	0	50	16.2		12	176	48	23.3	1	20	24.4
	29	121	07	59.1	0	52	09.5		13	178	02	52.3	1	19	36.0
	30	122	21	53.4	0	54	00.3		14	179	17	21.7	1	18	43.8
	31	123	35	48.9	+0	55	48.6		15	180	31	51.4	+1	17	47.9
Aug.	1	124	49	45.5	0	57	34.2		16	181	46	21.5	1	16	48.3
	2	126	03	43.0	0	59	17.1		17	183	00	52.0	1	15	45.2
	3	127	17	41.5	1	00	57.2		18	184	15	22.9	1	14	38.4
	4	128	31	40.9	1	02	34.5		19	185	29	54.2	1	13	28.0
	5	129	45	41.2	1	04	08.8		20	186	44	26.0	1	12	14.2
	6	130	59	42.4	+1	05	40.1		21	187	58	58.3	+1	10	56.9
	7	132	13	44.5	1	07	08.4		22	189	13	31.0	1	09	36.1
	8	133	27	47.4	1	08	33.5		23	190	28	04.1	1	08	12.0
	9	134	41	51.3	1	09	55.5		24	191	42	37.7	1	06	44.6
	10	135	55	56.0	1	11	14.3		25	192	57	11.6	1	05	13.8
	11	137	10	01.6	1	12	29.7		26	194	11	45.8	1	03	39.9
	12	138	24	08.1	+1	13	41.8		27	195	26	20.4	+1	02	02.7
	13	139	38	15.4	1	14	50.6		28	196	40	55.2	1	00	22.5
	14	140	52	23.6	1	15	55.9		29	197	55	30.1	0	58	39.2
	15	142	06	32.7	1	16	57.7		30	199	10	05.3	0	56	52.9
	16	143	20	42.6	+1	17	56.0	Oct.	1	200	24	40.7	+0	55	03.7

VENUS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Oct.	1	200	24	40.7	+0	55	03.7
	2	201	39	16.1	0	53	11.6
	3	202	53	51.6	0	51	16.7
	4	204	08	27.1	0	49	19.2
	5	205	23	02.6	0	47	19.0
	6	206	37	37.9	0	45	16.2
	7	207	52	13.1	+0	43	11.0
	8	209	06	48.2	0	41	03.4
	9	210	21	23.1	0	38	53.5
	10	211	35	57.9	0	36	41.4
	11	212	50	32.5	0	34	27.2
	12	214	05	06.9	0	32	10.9
	13	215	19	41.2	+0	29	52.7
	14	216	34	15.5	0	27	32.7
	15	217	48	49.7	0	25	10.8
	16	219	03	23.8	0	22	47.3
	17	220	17	57.9	0	20	22.3
	18	221	32	32.1	0	17	55.7
	19	222	47	06.3	+0	15	27.7
	20	224	01	40.6	0	12	58.5
	21	225	16	14.9	0	10	28.1
	22	226	30	49.2	0	07	56.5
	23	227	45	23.6	0	05	23.9
	24	228	59	57.9	0	02	50.5
	25	230	14	32.3	+0	00	16.2
	26	231	29	06.7	-0	02	18.8
	27	232	43	41.1	0	04	54.4
	28	233	58	15.4	0	07	30.5
	29	235	12	49.7	0	10	07.0
	30	236	27	24.0	0	12	43.7
	31	237	41	58.0	-0	15	20.7
Nov.	1	238	56	31.8	0	17	57.7
	2	240	11	05.4	0	20	34.7
	3	241	25	38.5	0	23	11.5
	4	242	40	11.3	0	25	48.0
	5	243	54	43.7	0	28	24.1
	6	245	09	15.6	-0	30	59.8
	7	246	23	47.0	0	33	34.8
	8	247	38	18.0	0	36	09.1
	9	248	52	48.5	0	38	42.5
	10	250	07	18.5	0	41	15.0
	11	251	21	48.2	0	43	46.5
	12	252	36	17.4	-0	46	16.7
	13	253	50	46.2	0	48	45.7
	14	255	05	14.7	0	51	13.3
	15	256	19	42.7	0	53	39.4
	16	257	34	10.5	-0	56	03.9

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Nov.	16	257	34	10.5	-0	56	03.9
	17	258	48	37.8	0	58	26.7
	18	260	03	04.9	1	00	47.7
	19	261	17	31.5	1	03	06.8
	20	262	31	57.8	1	05	23.9
	21	263	46	23.7	1	07	38.9
	22	265	00	49.3	-1	09	51.6
	23	266	15	14.6	1	12	02.1
	24	267	29	39.5	1	14	10.1
	25	268	44	04.1	1	16	15.6
	26	269	58	28.2	1	18	18.5
	27	271	12	51.9	1	20	18.6
	28	272	27	15.1	-1	22	16.0
	29	273	41	37.6	1	24	10.4
	30	274	55	59.4	1	26	01.8
Dec.	1	276	10	20.3	1	27	50.0
	2	277	24	40.4	1	29	35.0
	3	278	38	59.5	1	31	16.7
	4	279	53	17.5	-1	32	54.9
	5	281	07	34.5	1	34	29.7
	6	282	21	50.4	1	36	00.8
	7	283	36	05.2	1	37	28.2
	8	284	50	18.7	1	38	51.9
	9	286	04	31.1	1	40	11.6
	10	287	18	42.2	-1	41	27.5
	11	288	32	52.1	1	42	39.3
	12	289	47	00.7	1	43	46.9
	13	291	01	07.9	1	44	50.4
	14	292	15	13.8	1	45	49.7
	15	293	29	18.4	1	46	44.6
	16	294	43	21.5	-1	47	35.2
	17	295	57	23.2	1	48	21.3
	18	297	11	23.4	1	49	02.9
	19	298	25	22.1	1	49	39.9
	20	299	39	19.4	1	50	12.3
	21	300	53	15.2	1	50	40.0
	22	302	07	09.6	-1	51	03.0
	23	303	21	02.4	1	51	21.1
	24	304	34	53.5	1	51	34.5
	25	305	48	43.0	1	51	42.9
	26	307	02	30.6	1	51	46.4
	27	308	16	16.3	1	51	44.8
	28	309	29	59.9	-1	51	38.3
	29	310	43	41.2	1	51	26.6
	30	311	57	20.2	1	51	09.8
	31	313	10	56.8	1	50	47.8
	32	314	24	30.7	-1	50	20.6

VENUS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	15	24	03.98	-15	04	39.5	0.627 077	14.02	13.30	8	46	34
	1	15	27	59.52	15	18	38.6	0.634 664	13.86	13.14	8	46	34
	2	15	31	57.43	15	32	36.1	0.642 255	13.69	12.99	8	46	36
	3	15	35	57.64	15	46	30.7	0.649 850	13.53	12.83	8	46	41
	4	15	40	00.11	16	00	21.2	0.657 448	13.38	12.69	8	46	48
	5	15	44	04.78	16	14	06.5	0.665 048	13.22	12.54	8	46	56
	6	15	48	11.62	-16	27	45.2	0.672 649	13.07	12.40	8	47	08
	7	15	52	20.58	16	41	16.3	0.680 250	12.93	12.26	8	47	21
	8	15	56	31.61	16	54	38.5	0.687 851	12.78	12.12	8	47	36
	9	16	00	44.69	17	07	50.9	0.695 451	12.65	11.99	8	47	53
	10	16	04	59.76	17	20	52.2	0.703 050	12.51	11.86	8	48	12
	11	16	09	16.78	17	33	41.5	0.710 647	12.37	11.74	8	48	34
	12	16	13	35.74	-17	46	17.6	0.718 242	12.24	11.61	8	48	57
	13	16	17	56.58	17	58	39.5	0.725 834	12.12	11.49	8	49	22
	14	16	22	19.28	18	10	46.4	0.733 422	11.99	11.37	8	49	49
	15	16	26	43.79	18	22	37.1	0.741 007	11.87	11.25	8	50	17
	16	16	31	10.09	18	34	10.7	0.748 587	11.75	11.14	8	50	48
	17	16	35	38.15	18	45	26.4	0.756 163	11.63	11.03	8	51	20
	18	16	40	07.92	-18	56	23.2	0.763 734	11.51	10.92	8	51	54
	19	16	44	39.39	19	07	00.2	0.771 299	11.40	10.81	8	52	29
	20	16	49	12.50	19	17	16.7	0.778 858	11.29	10.71	8	53	06
	21	16	53	47.22	19	27	11.6	0.786 410	11.18	10.61	8	53	45
	22	16	58	23.52	19	36	44.3	0.793 954	11.08	10.50	8	54	25
	23	17	03	01.35	19	45	53.9	0.801 491	10.97	10.41	8	55	07
	24	17	07	40.68	-19	54	39.5	0.809 018	10.87	10.31	8	55	51
	25	17	12	21.46	20	03	00.5	0.816 535	10.77	10.21	8	56	35
	26	17	17	03.65	20	10	56.0	0.824 041	10.67	10.12	8	57	21
	27	17	21	47.20	20	18	25.3	0.831 535	10.58	10.03	8	58	09
	28	17	26	32.06	20	25	27.8	0.839 017	10.48	9.94	8	58	58
	29	17	31	18.17	20	32	02.7	0.846 486	10.39	9.85	8	59	48
	30	17	36	05.49	-20	38	09.5	0.853 942	10.30	9.77	9	00	39
	31	17	40	53.97	20	43	47.4	0.861 383	10.21	9.68	9	01	31
Feb.	1	17	45	43.53	20	48	56.0	0.868 810	10.12	9.60	9	02	25
	2	17	50	34.14	20	53	34.6	0.876 223	10.04	9.52	9	03	19
	3	17	55	25.72	20	57	42.7	0.883 620	9.95	9.44	9	04	15
	4	18	00	18.23	21	01	19.8	0.891 002	9.87	9.36	9	05	11
	5	18	05	11.60	-21	04	25.5	0.898 369	9.79	9.28	9	06	08
	6	18	10	05.79	21	06	59.3	0.905 720	9.71	9.21	9	07	06
	7	18	15	00.73	21	09	00.8	0.913 055	9.63	9.13	9	08	05
	8	18	19	56.36	21	10	29.6	0.920 374	9.55	9.06	9	09	04
	9	18	24	52.64	21	11	25.3	0.927 678	9.48	8.99	9	10	04
	10	18	29	49.50	21	11	47.7	0.934 965	9.41	8.92	9	11	05
	11	18	34	46.90	-21	11	36.5	0.942 236	9.33	8.85	9	12	06
	12	18	39	44.78	21	10	51.5	0.949 490	9.26	8.78	9	13	07
	13	18	44	43.08	21	09	32.3	0.956 729	9.19	8.72	9	14	09
	14	18	49	41.75	21	07	38.8	0.963 951	9.12	8.65	9	15	12
	15	18	54	40.74	-21	05	11.0	0.971 157	9.06	8.59	9	16	14

VENUS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	18	54	40.74	-21	05	11.0	0.971 157	9.06	8.59	9	16	14
	16	18	59	40.00	21	02	08.6	0.978 347	8.99	8.52	9	17	17
	17	19	04	39.48	20	58	31.6	0.985 520	8.92	8.46	9	18	20
	18	19	09	39.13	20	54	19.9	0.992 676	8.86	8.40	9	19	23
	19	19	14	38.88	20	49	33.4	0.999 815	8.80	8.34	9	20	27
	20	19	19	38.71	20	44	12.2	1.006 937	8.73	8.28	9	21	30
	21	19	24	38.56	-20	38	16.2	1.014 042	8.67	8.22	9	22	33
	22	19	29	38.38	20	31	45.4	1.021 127	8.61	8.17	9	23	37
	23	19	34	38.13	20	24	40.0	1.028 194	8.55	8.11	9	24	40
	24	19	39	37.75	20	17	00.0	1.035 241	8.49	8.06	9	25	43
	25	19	44	37.21	20	08	45.6	1.042 267	8.44	8.00	9	26	46
	26	19	49	36.46	19	59	56.9	1.049 274	8.38	7.95	9	27	48
	27	19	54	35.44	-19	50	34.1	1.056 258	8.33	7.90	9	28	51
	28	19	59	34.11	19	40	37.4	1.063 222	8.27	7.84	9	29	53
Mar.	1	20	04	32.43	19	30	07.2	1.070 163	8.22	7.79	9	30	54
	2	20	09	30.34	19	19	03.5	1.077 083	8.16	7.74	9	31	56
	3	20	14	27.82	19	07	26.9	1.083 980	8.11	7.69	9	32	56
	4	20	19	24.81	18	55	17.5	1.090 855	8.06	7.65	9	33	57
	5	20	24	21.29	-18	42	35.7	1.097 706	8.01	7.60	9	34	56
	6	20	29	17.22	18	29	21.8	1.104 535	7.96	7.55	9	35	56
	7	20	34	12.56	18	15	36.3	1.111 341	7.91	7.50	9	36	54
	8	20	39	07.28	18	01	19.5	1.118 124	7.87	7.46	9	37	52
	9	20	44	01.37	17	46	31.9	1.124 883	7.82	7.41	9	38	50
	10	20	48	54.79	17	31	13.9	1.131 620	7.77	7.37	9	39	46
	11	20	53	47.52	-17	15	26.0	1.138 333	7.73	7.33	9	40	42
	12	20	58	39.55	16	59	08.6	1.145 024	7.68	7.28	9	41	37
	13	21	03	30.85	16	42	22.2	1.151 691	7.64	7.24	9	42	32
	14	21	08	21.41	16	25	07.4	1.158 336	7.59	7.20	9	43	26
	15	21	13	11.22	16	07	24.6	1.164 957	7.55	7.16	9	44	19
	16	21	18	00.27	15	49	14.3	1.171 556	7.51	7.12	9	45	11
	17	21	22	48.55	-15	30	37.3	1.178 132	7.46	7.08	9	46	02
	18	21	27	36.05	15	11	33.9	1.184 684	7.42	7.04	9	46	53
	19	21	32	22.77	14	52	04.7	1.191 214	7.38	7.00	9	47	43
	20	21	37	08.71	14	32	10.2	1.197 721	7.34	6.96	9	48	32
	21	21	41	53.88	14	11	51.1	1.204 205	7.30	6.93	9	49	20
	22	21	46	38.27	13	51	07.9	1.210 664	7.26	6.89	9	50	08
	23	21	51	21.90	-13	30	01.1	1.217 099	7.23	6.85	9	50	54
	24	21	56	04.77	13	08	31.4	1.223 509	7.19	6.82	9	51	41
	25	22	00	46.90	12	46	39.3	1.229 894	7.15	6.78	9	52	26
	26	22	05	28.27	12	24	25.5	1.236 252	7.11	6.75	9	53	10
	27	22	10	08.91	12	01	50.6	1.242 584	7.08	6.71	9	53	54
	28	22	14	48.82	11	38	55.2	1.248 889	7.04	6.68	9	54	37
	29	22	19	28.01	-11	15	40.0	1.255 167	7.01	6.64	9	55	20
	30	22	24	06.48	10	52	05.6	1.261 416	6.97	6.61	9	56	01
	31	22	28	44.26	10	28	12.6	1.267 638	6.94	6.58	9	56	42
Apr.	1	22	33	21.35	10	04	01.8	1.273 830	6.90	6.55	9	57	22
	2	22	37	57.77	-9	39	33.8	1.279 994	6.87	6.52	9	58	02

VENUS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	22	33	21.35	-10	04	01.8	1.273 830	6.90	6.55	9	57	22
	2	22	37	57.77	9	39	33.8	1.279 994	6.87	6.52	9	58	02
	3	22	42	33.54	9	14	49.2	1.286 129	6.84	6.48	9	58	41
	4	22	47	08.67	8	49	48.7	1.292 234	6.81	6.45	9	59	19
	5	22	51	43.19	8	24	33.0	1.298 310	6.77	6.42	9	59	57
	6	22	56	17.12	7	59	02.7	1.304 356	6.74	6.39	10	00	34
	7	23	00	50.47	-7	33	18.5	1.310 372	6.71	6.36	10	01	11
	8	23	05	23.28	7	07	21.0	1.316 357	6.68	6.34	10	01	47
	9	23	09	55.57	6	41	10.9	1.322 313	6.65	6.31	10	02	22
	10	23	14	27.36	6	14	49.0	1.328 239	6.62	6.28	10	02	58
	11	23	18	58.68	5	48	15.8	1.334 134	6.59	6.25	10	03	32
	12	23	23	29.56	5	21	32.1	1.339 999	6.56	6.22	10	04	06
	13	23	28	00.02	-4	54	38.4	1.345 834	6.53	6.20	10	04	40
	14	23	32	30.11	4	27	35.6	1.351 640	6.51	6.17	10	05	13
	15	23	36	59.84	4	00	24.2	1.357 414	6.48	6.14	10	05	46
	16	23	41	29.25	3	33	04.9	1.363 159	6.45	6.12	10	06	19
	17	23	45	58.38	3	05	38.4	1.368 874	6.42	6.09	10	06	52
	18	23	50	27.26	2	38	05.2	1.374 557	6.40	6.07	10	07	24
	19	23	54	55.94	-2	10	26.0	1.380 210	6.37	6.04	10	07	56
	20	23	59	24.45	1	42	41.5	1.385 832	6.35	6.02	10	08	28
	21	0	03	52.82	1	14	52.3	1.391 421	6.32	5.99	10	08	60
	22	0	08	21.10	0	46	59.1	1.396 979	6.30	5.97	10	09	31
	23	0	12	49.32	-0	19	02.4	1.402 503	6.27	5.95	10	10	03
	24	0	17	17.52	+0	08	56.9	1.407 993	6.25	5.92	10	10	35
	25	0	21	45.72	0	36	58.4	1.413 450	6.22	5.90	10	11	06
	26	0	26	13.96	1	05	01.2	1.418 871	6.20	5.88	10	11	38
	27	0	30	42.27	1	33	04.6	1.424 257	6.17	5.86	10	12	10
	28	0	35	10.70	2	01	08.1	1.429 608	6.15	5.83	10	12	42
	29	0	39	39.27	2	29	11.0	1.434 922	6.13	5.81	10	13	14
	30	0	44	08.02	2	57	12.5	1.440 199	6.11	5.79	10	13	46
May	1	0	48	36.98	+3	25	11.9	1.445 438	6.08	5.77	10	14	19
	2	0	53	06.20	3	53	08.7	1.450 640	6.06	5.75	10	14	52
	3	0	57	35.69	4	21	02.0	1.455 804	6.04	5.73	10	15	25
	4	1	02	05.51	4	48	51.3	1.460 930	6.02	5.71	10	15	58
	5	1	06	35.67	5	16	35.9	1.466 016	6.00	5.69	10	16	32
	6	1	11	06.23	5	44	14.9	1.471 063	5.98	5.67	10	17	06
	7	1	15	37.20	+6	11	47.9	1.476 071	5.96	5.65	10	17	41
	8	1	20	08.63	6	39	13.9	1.481 040	5.94	5.63	10	18	16
	9	1	24	40.54	7	06	32.5	1.485 969	5.92	5.61	10	18	51
	10	1	29	12.97	7	33	42.7	1.490 858	5.90	5.59	10	19	27
	11	1	33	45.95	8	00	44.1	1.495 707	5.88	5.58	10	20	04
	12	1	38	19.51	8	27	35.7	1.500 517	5.86	5.56	10	20	41
	13	1	42	53.69	+8	54	17.0	1.505 287	5.84	5.54	10	21	19
	14	1	47	28.51	9	20	47.3	1.510 017	5.82	5.52	10	21	58
	15	1	52	04.02	9	47	05.9	1.514 707	5.81	5.51	10	22	37
	16	1	56	40.24	10	13	12.0	1.519 357	5.79	5.49	10	23	17
	17	2	01	17.22	+10	39	05.1	1.523 967	5.77	5.47	10	23	58

VENUS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	2	01	17.22	+10	39	05.1	1.523 967	5.77	5.47	10	23	58
	18	2	05	54.99	11	04	44.4	1.528 536	5.75	5.46	10	24	40
	19	2	10	33.58	11	30	09.3	1.533 063	5.74	5.44	10	25	22
	20	2	15	13.01	11	55	19.0	1.537 549	5.72	5.42	10	26	05
	21	2	19	53.32	12	20	12.9	1.541 993	5.70	5.41	10	26	49
	22	2	24	34.54	12	44	50.3	1.546 394	5.69	5.39	10	27	35
	23	2	29	16.68	+13	09	10.5	1.550 751	5.67	5.38	10	28	21
	24	2	33	59.77	13	33	12.7	1.555 065	5.66	5.36	10	29	08
	25	2	38	43.83	13	56	56.3	1.559 334	5.64	5.35	10	29	55
	26	2	43	28.88	14	20	20.5	1.563 558	5.62	5.33	10	30	44
	27	2	48	14.94	14	43	24.6	1.567 737	5.61	5.32	10	31	34
	28	2	53	02.04	15	06	07.9	1.571 869	5.59	5.31	10	32	25
	29	2	57	50.18	+15	28	29.7	1.575 954	5.58	5.29	10	33	18
	30	3	02	39.38	15	50	29.2	1.579 992	5.57	5.28	10	34	11
	31	3	07	29.65	16	12	05.8	1.583 982	5.55	5.27	10	35	05
June	1	3	12	21.01	16	33	18.8	1.587 924	5.54	5.25	10	36	00
	2	3	17	13.46	16	54	07.4	1.591 817	5.52	5.24	10	36	57
	3	3	22	07.01	17	14	30.9	1.595 661	5.51	5.23	10	37	54
	4	3	27	01.66	+17	34	28.7	1.599 455	5.50	5.21	10	38	53
	5	3	31	57.42	17	54	00.0	1.603 200	5.49	5.20	10	39	53
	6	3	36	54.28	18	13	04.2	1.606 895	5.47	5.19	10	40	53
	7	3	41	52.24	18	31	40.5	1.610 539	5.46	5.18	10	41	55
	8	3	46	51.29	18	49	48.3	1.614 134	5.45	5.17	10	42	58
	9	3	51	51.42	19	07	26.8	1.617 679	5.44	5.16	10	44	02
	10	3	56	52.64	+19	24	35.5	1.621 174	5.42	5.14	10	45	08
	11	4	01	54.93	19	41	13.7	1.624 618	5.41	5.13	10	46	14
	12	4	06	58.29	19	57	20.7	1.628 013	5.40	5.12	10	47	21
	13	4	12	02.71	20	12	55.9	1.631 357	5.39	5.11	10	48	30
	14	4	17	08.17	20	27	58.7	1.634 652	5.38	5.10	10	49	39
	15	4	22	14.66	20	42	28.6	1.637 896	5.37	5.09	10	50	49
	16	4	27	22.17	+20	56	25.0	1.641 089	5.36	5.08	10	52	01
	17	4	32	30.67	21	09	47.2	1.644 232	5.35	5.07	10	53	13
	18	4	37	40.14	21	22	34.8	1.647 324	5.34	5.06	10	54	27
	19	4	42	50.55	21	34	47.3	1.650 364	5.33	5.05	10	55	41
	20	4	48	01.88	21	46	24.0	1.653 352	5.32	5.04	10	56	56
	21	4	53	14.09	21	57	24.5	1.656 288	5.31	5.04	10	58	12
	22	4	58	27.15	+22	07	48.3	1.659 170	5.30	5.03	10	59	29
	23	5	03	41.03	22	17	34.9	1.662 000	5.29	5.02	11	00	47
	24	5	08	55.70	22	26	43.8	1.664 776	5.28	5.01	11	02	06
	25	5	14	11.10	22	35	14.7	1.667 497	5.27	5.00	11	03	25
	26	5	19	27.21	22	43	07.1	1.670 164	5.27	4.99	11	04	45
	27	5	24	43.97	22	50	20.6	1.672 776	5.26	4.99	11	06	05
	28	5	30	01.36	+22	56	54.9	1.675 333	5.25	4.98	11	07	27
	29	5	35	19.30	23	02	49.6	1.677 833	5.24	4.97	11	08	48
	30	5	40	37.77	23	08	04.4	1.680 277	5.23	4.96	11	10	11
July	1	5	45	56.70	23	12	39.1	1.682 664	5.23	4.96	11	11	33
	2	5	51	16.05	+23	16	33.3	1.684 994	5.22	4.95	11	12	56

VENUS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	5	45	56.70	+23	12	39.1	1.682 664	5.23	4.96	11	11	33
	2	5	51	16.05	23	16	33.3	1.684 994	5.22	4.95	11	12	56
	3	5	56	35.75	23	19	47.0	1.687 267	5.21	4.94	11	14	20
	4	6	01	55.75	23	22	19.8	1.689 482	5.21	4.94	11	15	43
	5	6	07	16.00	23	24	11.6	1.691 640	5.20	4.93	11	17	07
	6	6	12	36.42	23	25	22.2	1.693 740	5.19	4.92	11	18	31
	7	6	17	56.96	+23	25	51.6	1.695 783	5.19	4.92	11	19	55
	8	6	23	17.57	23	25	39.6	1.697 768	5.18	4.91	11	21	19
	9	6	28	38.20	23	24	46.2	1.699 697	5.17	4.91	11	22	44
	10	6	33	58.78	23	23	11.3	1.701 569	5.17	4.90	11	24	08
	11	6	39	19.27	23	20	55.0	1.703 384	5.16	4.90	11	25	32
	12	6	44	39.61	23	17	57.3	1.705 142	5.16	4.89	11	26	55
	13	6	49	59.75	+23	14	18.4	1.706 844	5.15	4.89	11	28	19
	14	6	55	19.64	23	09	58.2	1.708 490	5.15	4.88	11	29	42
	15	7	00	39.22	23	04	57.0	1.710 080	5.14	4.88	11	31	05
	16	7	05	58.44	22	59	14.9	1.711 613	5.14	4.87	11	32	28
	17	7	11	17.25	22	52	52.1	1.713 090	5.13	4.87	11	33	50
	18	7	16	35.61	22	45	48.9	1.714 510	5.13	4.86	11	35	11
	19	7	21	53.46	+22	38	05.3	1.715 874	5.13	4.86	11	36	32
	20	7	27	10.76	22	29	41.8	1.717 181	5.12	4.86	11	37	53
	21	7	32	27.45	22	20	38.6	1.718 432	5.12	4.85	11	39	13
	22	7	37	43.51	22	10	56.0	1.719 625	5.11	4.85	11	40	32
	23	7	42	58.89	22	00	34.3	1.720 761	5.11	4.85	11	41	51
	24	7	48	13.55	21	49	34.0	1.721 839	5.11	4.84	11	43	09
	25	7	53	27.45	+21	37	55.3	1.722 860	5.10	4.84	11	44	26
	26	7	58	40.56	21	25	38.8	1.723 822	5.10	4.84	11	45	42
	27	8	03	52.84	21	12	44.8	1.724 727	5.10	4.84	11	46	57
	28	8	09	04.26	20	59	13.9	1.725 573	5.10	4.83	11	48	12
	29	8	14	14.79	20	45	06.4	1.726 360	5.09	4.83	11	49	25
	30	8	19	24.40	20	30	22.9	1.727 089	5.09	4.83	11	50	38
	31	8	24	33.05	+20	15	04.0	1.727 759	5.09	4.83	11	51	50
Aug.	1	8	29	40.73	19	59	10.2	1.728 370	5.09	4.83	11	53	00
	2	8	34	47.39	19	42	42.0	1.728 921	5.09	4.82	11	54	10
	3	8	39	53.03	19	25	40.1	1.729 414	5.09	4.82	11	55	19
	4	8	44	57.62	19	08	04.9	1.729 848	5.08	4.82	11	56	26
	5	8	50	01.15	18	49	57.1	1.730 223	5.08	4.82	11	57	33
	6	8	55	03.60	+18	31	17.3	1.730 540	5.08	4.82	11	58	38
	7	9	00	04.97	18	12	06.2	1.730 800	5.08	4.82	11	59	42
	8	9	05	05.24	17	52	24.3	1.731 003	5.08	4.82	12	00	46
	9	9	10	04.43	17	32	12.3	1.731 149	5.08	4.82	12	01	48
	10	9	15	02.53	17	11	30.9	1.731 239	5.08	4.82	12	02	49
	11	9	19	59.52	16	50	20.8	1.731 273	5.08	4.82	12	03	49
	12	9	24	55.43	+16	28	42.6	1.731 251	5.08	4.82	12	04	47
	13	9	29	50.25	16	06	37.1	1.731 175	5.08	4.82	12	05	45
	14	9	34	43.99	15	44	04.8	1.731 043	5.08	4.82	12	06	42
	15	9	39	36.66	15	21	06.5	1.730 856	5.08	4.82	12	07	38
	16	9	44	28.27	+14	57	42.8	1.730 615	5.08	4.82	12	08	32

VENUS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	9	44	28.27	+14	57	42.8	1.730 615	5.08	4.82	12	08	32
	17	9	49	18.84	14	33	54.5	1.730 319	5.08	4.82	12	09	26
	18	9	54	08.37	14	09	42.3	1.729 969	5.08	4.82	12	10	18
	19	9	58	56.89	13	45	06.8	1.729 565	5.08	4.82	12	11	10
	20	10	03	44.43	13	20	08.8	1.729 107	5.09	4.82	12	12	00
	21	10	08	30.99	12	54	49.0	1.728 596	5.09	4.82	12	12	50
	22	10	13	16.60	+12	29	08.1	1.728 030	5.09	4.83	12	13	38
	23	10	18	01.29	12	03	06.7	1.727 410	5.09	4.83	12	14	26
	24	10	22	45.08	11	36	45.7	1.726 737	5.09	4.83	12	15	13
	25	10	27	28.00	11	10	05.6	1.726 009	5.10	4.83	12	15	59
	26	10	32	10.08	10	43	07.3	1.725 228	5.10	4.83	12	16	44
	27	10	36	51.33	10	15	51.5	1.724 393	5.10	4.84	12	17	28
	28	10	41	31.78	+9	48	19.0	1.723 504	5.10	4.84	12	18	12
	29	10	46	11.47	9	20	30.4	1.722 560	5.11	4.84	12	18	54
	30	10	50	50.42	8	52	26.4	1.721 563	5.11	4.84	12	19	37
	31	10	55	28.66	8	24	08.0	1.720 512	5.11	4.85	12	20	18
Sept.	1	11	00	06.21	7	55	35.7	1.719 407	5.11	4.85	12	20	59
	2	11	04	43.12	7	26	50.3	1.718 249	5.12	4.85	12	21	39
	3	11	09	19.41	+6	57	52.5	1.717 038	5.12	4.86	12	22	18
	4	11	13	55.13	6	28	43.1	1.715 775	5.13	4.86	12	22	57
	5	11	18	30.31	5	59	22.8	1.714 459	5.13	4.86	12	23	35
	6	11	23	04.98	5	29	52.4	1.713 093	5.13	4.87	12	24	13
	7	11	27	39.18	5	00	12.6	1.711 677	5.14	4.87	12	24	51
	8	11	32	12.95	4	30	24.1	1.710 210	5.14	4.88	12	25	28
	9	11	36	46.34	+4	00	27.6	1.708 693	5.15	4.88	12	26	04
	10	11	41	19.37	3	30	23.9	1.707 128	5.15	4.89	12	26	41
	11	11	45	52.08	3	00	13.8	1.705 515	5.16	4.89	12	27	17
	12	11	50	24.53	2	29	57.8	1.703 853	5.16	4.89	12	27	52
	13	11	54	56.75	1	59	36.8	1.702 143	5.17	4.90	12	28	28
	14	11	59	28.79	1	29	11.5	1.700 387	5.17	4.90	12	29	04
	15	12	04	00.69	0	58	42.6	1.698 583	5.18	4.91	12	29	39
	16	12	08	32.49	+0	28	10.8	1.696 733	5.18	4.92	12	30	14
	17	12	13	04.25	-0	02	23.3	1.694 837	5.19	4.92	12	30	49
	18	12	17	35.99	0	32	58.7	1.692 895	5.19	4.93	12	31	24
	19	12	22	07.78	1	03	35.0	1.690 907	5.20	4.93	12	31	60
	20	12	26	39.65	1	34	11.3	1.688 874	5.21	4.94	12	32	35
	21	12	31	11.64	-2	04	46.9	1.686 795	5.21	4.94	12	33	11
	22	12	35	43.81	2	35	21.1	1.684 671	5.22	4.95	12	33	46
	23	12	40	16.19	3	05	53.1	1.682 501	5.23	4.96	12	34	22
	24	12	44	48.82	3	36	22.3	1.680 287	5.23	4.96	12	34	59
	25	12	49	21.75	4	06	47.8	1.678 027	5.24	4.97	12	35	35
	26	12	53	55.02	4	37	09.0	1.675 722	5.25	4.98	12	36	12
	27	12	58	28.66	-5	07	25.0	1.673 372	5.26	4.98	12	36	49
	28	13	03	02.72	5	37	35.1	1.670 976	5.26	4.99	12	37	27
	29	13	07	37.23	6	07	38.6	1.668 536	5.27	5.00	12	38	05
	30	13	12	12.24	6	37	34.6	1.666 050	5.28	5.01	12	38	44
Oct.	1	13	16	47.79	-7	07	22.5	1.663 520	5.29	5.01	12	39	24

VENUS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	13	16	47.79	-7	07	22.5	1.663 520	5.29	5.01	12	39	24
	2	13	21	23.91	7	37	01.4	1.660 946	5.29	5.02	12	40	03
	3	13	26	00.65	8	06	30.7	1.658 328	5.30	5.03	12	40	44
	4	13	30	38.03	8	35	49.4	1.655 667	5.31	5.04	12	41	25
	5	13	35	16.10	9	04	56.9	1.652 963	5.32	5.05	12	42	07
	6	13	39	54.89	9	33	52.3	1.650 217	5.33	5.05	12	42	50
	7	13	44	34.44	-10	02	34.9	1.647 430	5.34	5.06	12	43	33
	8	13	49	14.77	10	31	03.8	1.644 602	5.35	5.07	12	44	17
	9	13	53	55.93	10	59	18.4	1.641 733	5.36	5.08	12	45	02
	10	13	58	37.96	11	27	17.8	1.638 825	5.37	5.09	12	45	48
	11	14	03	20.88	11	55	01.2	1.635 877	5.38	5.10	12	46	35
	12	14	08	04.73	12	22	27.9	1.632 890	5.39	5.11	12	47	23
	13	14	12	49.54	-12	49	37.1	1.629 864	5.40	5.12	12	48	12
	14	14	17	35.35	13	16	28.0	1.626 800	5.41	5.13	12	49	02
	15	14	22	22.18	13	42	59.8	1.623 699	5.42	5.14	12	49	53
	16	14	27	10.07	14	09	11.8	1.620 560	5.43	5.15	12	50	45
	17	14	31	59.04	14	35	03.2	1.617 383	5.44	5.16	12	51	38
	18	14	36	49.13	15	00	33.1	1.614 170	5.45	5.17	12	52	32
	19	14	41	40.34	-15	25	40.9	1.610 920	5.46	5.18	12	53	27
	20	14	46	32.71	15	50	25.8	1.607 633	5.47	5.19	12	54	24
	21	14	51	26.26	16	14	46.8	1.604 309	5.48	5.20	12	55	21
	22	14	56	21.00	16	38	43.3	1.600 949	5.49	5.21	12	56	20
	23	15	01	16.94	17	02	14.5	1.597 553	5.50	5.22	12	57	20
	24	15	06	14.10	17	25	19.6	1.594 119	5.52	5.23	12	58	22
	25	15	11	12.49	-17	47	57.7	1.590 649	5.53	5.24	12	59	24
	26	15	16	12.12	18	10	08.1	1.587 142	5.54	5.25	13	00	28
	27	15	21	12.99	18	31	50.0	1.583 598	5.55	5.27	13	01	33
	28	15	26	15.11	18	53	02.6	1.580 018	5.57	5.28	13	02	39
	29	15	31	18.48	19	13	45.1	1.576 400	5.58	5.29	13	03	47
	30	15	36	23.10	19	33	56.8	1.572 745	5.59	5.30	13	04	56
	31	15	41	28.95	-19	53	37.0	1.569 054	5.60	5.32	13	06	06
Nov.	1	15	46	36.03	20	12	44.7	1.565 327	5.62	5.33	13	07	17
	2	15	51	44.31	20	31	19.4	1.561 564	5.63	5.34	13	08	29
	3	15	56	53.80	20	49	20.3	1.557 765	5.65	5.35	13	09	43
	4	16	02	04.46	21	06	46.6	1.553 931	5.66	5.37	13	10	58
	5	16	07	16.29	21	23	37.7	1.550 063	5.67	5.38	13	12	14
	6	16	12	29.25	-21	39	52.8	1.546 160	5.69	5.39	13	13	31
	7	16	17	43.33	21	55	31.2	1.542 224	5.70	5.41	13	14	49
	8	16	22	58.50	22	10	32.4	1.538 254	5.72	5.42	13	16	08
	9	16	28	14.72	22	24	55.6	1.534 252	5.73	5.44	13	17	29
	10	16	33	31.98	22	38	40.3	1.530 216	5.75	5.45	13	18	50
	11	16	38	50.24	22	51	45.9	1.526 149	5.76	5.46	13	20	12
	12	16	44	09.46	-23	04	11.8	1.522 049	5.78	5.48	13	21	36
	13	16	49	29.60	23	15	57.5	1.517 918	5.79	5.49	13	22	60
	14	16	54	50.62	23	27	02.4	1.513 755	5.81	5.51	13	24	25
	15	17	00	12.48	23	37	26.1	1.509 562	5.83	5.52	13	25	51
	16	17	05	35.14	-23	47	08.0	1.505 337	5.84	5.54	13	27	17

VENUS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	17	05	35.14	-23	47	08.0	1.505 337	5.84	5.54	13	27	17
	17	17	10	58.53	23	56	07.8	1.501 082	5.86	5.56	13	28	44
	18	17	16	22.62	24	04	25.1	1.496 796	5.88	5.57	13	30	12
	19	17	21	47.34	24	11	59.3	1.492 480	5.89	5.59	13	31	41
	20	17	27	12.64	24	18	50.2	1.488 132	5.91	5.60	13	33	10
	21	17	32	38.46	24	24	57.5	1.483 754	5.93	5.62	13	34	40
	22	17	38	04.74	-24	30	20.7	1.479 344	5.94	5.64	13	36	10
	23	17	43	31.43	24	34	59.7	1.474 903	5.96	5.65	13	37	40
	24	17	48	58.46	24	38	54.1	1.470 431	5.98	5.67	13	39	11
	25	17	54	25.76	24	42	03.8	1.465 927	6.00	5.69	13	40	42
	26	17	59	53.26	24	44	28.7	1.461 390	6.02	5.71	13	42	13
	27	18	05	20.91	24	46	08.5	1.456 822	6.04	5.72	13	43	44
	28	18	10	48.62	-24	47	03.2	1.452 222	6.06	5.74	13	45	16
	29	18	16	16.32	24	47	12.8	1.447 589	6.08	5.76	13	46	47
	30	18	21	43.93	24	46	37.1	1.442 925	6.09	5.78	13	48	18
Dec.	1	18	27	11.39	24	45	16.3	1.438 229	6.11	5.80	13	49	49
	2	18	32	38.62	24	43	10.3	1.433 502	6.13	5.82	13	51	19
	3	18	38	05.55	24	40	19.2	1.428 743	6.16	5.84	13	52	50
	4	18	43	32.11	-24	36	43.1	1.423 953	6.18	5.86	13	54	19
	5	18	48	58.24	24	32	22.3	1.419 132	6.20	5.88	13	55	49
	6	18	54	23.86	24	27	16.8	1.414 281	6.22	5.90	13	57	18
	7	18	59	48.91	24	21	26.8	1.409 399	6.24	5.92	13	58	46
	8	19	05	13.33	24	14	52.8	1.404 488	6.26	5.94	14	00	13
	9	19	10	37.06	24	07	34.8	1.399 546	6.28	5.96	14	01	40
	10	19	16	00.04	-23	59	33.3	1.394 576	6.31	5.98	14	03	06
	11	19	21	22.20	23	50	48.7	1.389 576	6.33	6.00	14	04	32
	12	19	26	43.51	23	41	21.2	1.384 548	6.35	6.02	14	05	56
	13	19	32	03.89	23	31	11.4	1.379 490	6.37	6.05	14	07	19
	14	19	37	23.30	23	20	19.7	1.374 405	6.40	6.07	14	08	41
	15	19	42	41.70	23	08	46.5	1.369 291	6.42	6.09	14	10	03
	16	19	47	59.03	-22	56	32.4	1.364 149	6.45	6.11	14	11	23
	17	19	53	15.26	22	43	37.8	1.358 979	6.47	6.14	14	12	42
	18	19	58	30.34	22	30	03.3	1.353 781	6.50	6.16	14	13	60
	19	20	03	44.24	22	15	49.4	1.348 555	6.52	6.18	14	15	17
	20	20	08	56.92	22	00	56.8	1.343 299	6.55	6.21	14	16	32
	21	20	14	08.35	21	45	25.9	1.338 015	6.57	6.23	14	17	46
	22	20	19	18.51	-21	29	17.5	1.332 702	6.60	6.26	14	18	59
	23	20	24	27.37	21	12	32.1	1.327 360	6.63	6.28	14	20	11
	24	20	29	34.89	20	55	10.4	1.321 987	6.65	6.31	14	21	21
	25	20	34	41.06	20	37	13.1	1.316 585	6.68	6.33	14	22	30
	26	20	39	45.86	20	18	41.0	1.311 153	6.71	6.36	14	23	37
	27	20	44	49.24	19	59	34.6	1.305 690	6.74	6.39	14	24	43
	28	20	49	51.21	-19	39	54.9	1.300 196	6.76	6.41	14	25	48
	29	20	54	51.74	19	19	42.4	1.294 672	6.79	6.44	14	26	51
	30	20	59	50.82	18	58	57.9	1.289 118	6.82	6.47	14	27	53
	31	21	04	48.44	18	37	42.3	1.283 533	6.85	6.50	14	28	53
	32	21	09	44.59	-18	15	56.2	1.277 918	6.88	6.53	14	29	52

MARS, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector	Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector
Jan.	1	41 40 09.3	-0 15 31.4	1.453 5036	Apr.	3	90 29 09.0	+1 12 29.5	1.570 1552
	3	42 48 48.9	0 13 19.5	1.455 8872		5	91 28 01.2	1 13 55.2	1.572 5342
	5	43 57 15.0	0 11 07.7	1.458 2916		7	92 26 42.8	1 15 19.3	1.574 8942
	7	45 05 27.5	0 08 56.1	1.460 7160		9	93 25 14.1	1 16 41.9	1.577 2347
	9	46 13 26.3	0 06 44.7	1.463 1593		11	94 23 35.0	1 18 02.9	1.579 5551
	11	47 21 11.5	0 04 33.6	1.465 6205		13	95 21 45.7	1 19 22.3	1.581 8548
	13	48 28 43.0	-0 02 22.8	1.468 0986		15	96 19 46.5	+1 20 40.2	1.584 1331
	15	49 36 00.8	-0 00 12.5	1.470 5925		17	97 17 37.3	1 21 56.4	1.586 3895
	17	50 43 04.9	+0 01 57.5	1.473 1012		19	98 15 18.4	1 23 11.0	1.588 6234
	19	51 49 55.3	0 04 06.9	1.475 6238		21	99 12 49.9	1 24 24.1	1.590 8342
	21	52 56 32.0	0 06 15.8	1.478 1592		23	100 10 11.9	1 25 35.5	1.593 0214
	23	54 02 55.0	0 08 24.1	1.480 7065		25	101 07 24.6	1 26 45.3	1.595 1845
	25	55 09 04.2	+0 10 31.9	1.483 2647		27	102 04 28.1	+1 27 53.5	1.597 3228
	27	56 14 59.8	0 12 38.9	1.485 8327		29	103 01 22.5	1 29 00.1	1.599 4359
	29	57 20 41.8	0 14 45.2	1.488 4096	May	1	103 58 08.1	1 30 05.0	1.601 5233
	31	58 26 10.0	0 16 50.7	1.490 9945		3	104 54 44.9	1 31 08.3	1.603 5845
Feb.	2	59 31 24.8	0 18 55.5	1.493 5863		5	105 51 13.1	1 32 09.9	1.605 6189
	4	60 36 25.9	0 20 59.4	1.496 1841		7	106 47 32.8	1 33 09.9	1.607 6262
	6	61 41 13.5	+0 23 02.4	1.498 7870		9	107 43 44.2	+1 34 08.3	1.609 6057
	8	62 45 47.7	0 25 04.5	1.501 3940		11	108 39 47.4	1 35 05.0	1.611 5571
	10	63 50 08.6	0 27 05.7	1.504 0041		13	109 35 42.6	1 36 00.1	1.613 4800
	12	64 54 16.0	0 29 05.9	1.506 6166		15	110 31 30.0	1 36 53.5	1.615 3738
	14	65 58 10.1	0 31 05.0	1.509 2304		17	111 27 09.6	1 37 45.3	1.617 2381
	16	67 01 51.1	0 33 03.1	1.511 8446		19	112 22 41.6	1 38 35.4	1.619 0726
	18	68 05 18.9	+0 35 00.2	1.514 4583		21	113 18 06.1	+1 39 23.9	1.620 8768
	20	69 08 33.6	0 36 56.1	1.517 0708		23	114 13 23.5	1 40 10.7	1.622 6503
	22	70 11 35.3	0 38 50.8	1.519 6809		25	115 08 33.6	1 40 55.9	1.624 3927
	24	71 14 24.1	0 40 44.4	1.522 2880		27	116 03 36.8	1 41 39.4	1.626 1036
	26	72 17 00.1	0 42 36.8	1.524 8912		29	116 58 33.1	1 42 21.4	1.627 7827
	28	73 19 23.3	0 44 28.0	1.527 4895		31	117 53 22.7	1 43 01.6	1.629 4296
Mar.	2	74 21 33.9	+0 46 17.9	1.530 0822	June	2	118 48 05.8	+1 43 40.1	1.631 0440
	4	75 23 31.9	0 48 06.5	1.532 6684		4	119 42 42.5	1 44 17.1	1.632 6254
	6	76 25 17.5	0 49 53.9	1.535 2473		6	120 37 13.0	1 44 52.4	1.634 1737
	8	77 26 50.7	0 51 39.9	1.537 8182		8	121 31 37.4	1 45 26.0	1.635 6883
	10	78 28 11.7	0 53 24.6	1.540 3801		10	122 25 55.8	1 45 58.1	1.637 1691
	12	79 29 20.5	0 55 07.9	1.542 9324		12	123 20 08.4	1 46 28.4	1.638 6157
	14	80 30 17.3	+0 56 49.8	1.545 4742		14	124 14 15.4	+1 46 57.2	1.640 0278
	16	81 31 02.2	0 58 30.4	1.548 0048		16	125 08 16.9	1 47 24.3	1.641 4051
	18	82 31 35.3	1 00 09.5	1.550 5235		18	126 02 13.1	1 47 49.7	1.642 7474
	20	83 31 56.7	1 01 47.2	1.553 0294		20	126 56 04.0	1 48 13.6	1.644 0543
	22	84 32 06.5	1 03 23.4	1.555 5219		22	127 49 50.0	1 48 35.8	1.645 3257
	24	85 32 04.8	1 04 58.2	1.558 0003		24	128 43 31.0	1 48 56.4	1.646 5612
	26	86 31 51.8	+1 06 31.4	1.560 4637		26	129 37 07.3	+1 49 15.4	1.647 7606
	28	87 31 27.6	1 08 03.2	1.562 9117		28	130 30 39.0	1 49 32.8	1.648 9236
	30	88 30 52.3	1 09 33.5	1.565 3433		30	131 24 06.3	1 49 48.5	1.650 0501
Apr.	1	89 30 06.1	1 11 02.3	1.567 7581	July	2	132 17 29.2	1 50 02.7	1.651 1398
	3	90 29 09.0	+1 12 29.5	1.570 1552		4	133 10 48.1	+1 50 15.1	1.652 1925

MARS, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude ° ′ ″	Heliocentric Latitude ° ′ ″	Radius Vector	Date		Heliocentric Longitude ° ′ ″	Heliocentric Latitude ° ′ ″	Radius Vector
July	2	132 17 29.2	+1 50 02.7	1.651 1398	Oct.	2	172 38 53.3	+1 33 08.9	1.659 2952
	4	133 10 48.1	1 50 15.1	1.652 1925		4	173 31 43.1	1 32 12.6	1.658 5471
	6	134 04 02.9	1 50 26.1	1.653 2080		6	174 24 35.9	1 31 15.0	1.657 7605
	8	134 57 13.9	1 50 35.4	1.654 1860		8	175 17 31.8	1 30 16.0	1.656 9356
	10	135 50 21.2	1 50 43.2	1.655 1265		10	176 10 30.7	1 29 15.7	1.656 0725
	12	136 43 24.9	1 50 49.3	1.656 0292		12	177 03 33.1	1 28 14.0	1.655 1715
	14	137 36 25.3	+1 50 53.9	1.656 8939		14	177 56 38.9	+1 27 11.0	1.654 2325
	16	138 29 22.4	1 50 56.8	1.657 7205		16	178 49 48.3	1 26 06.7	1.653 2560
	18	139 22 16.5	1 50 58.2	1.658 5088		18	179 43 01.6	1 25 01.1	1.652 2420
	20	140 15 07.6	1 50 58.0	1.659 2587		20	180 36 18.8	1 23 54.1	1.651 1907
	22	141 07 55.9	1 50 56.3	1.659 9700		22	181 29 40.1	1 22 45.9	1.650 1024
	24	142 00 41.5	1 50 53.0	1.660 6425		24	182 23 05.6	1 21 36.4	1.648 9772
	26	142 53 24.7	+1 50 48.1	1.661 2763		26	183 16 35.6	+1 20 25.6	1.647 8155
	28	143 46 05.5	1 50 41.7	1.661 8710		28	184 10 10.0	1 19 13.5	1.646 6173
	30	144 38 44.1	1 50 33.7	1.662 4267		30	185 03 49.2	1 18 00.2	1.645 3830
Aug.	1	145 31 20.7	1 50 24.2	1.662 9433	Nov.	1	185 57 33.2	1 16 45.6	1.644 1127
	3	146 23 55.4	1 50 13.1	1.663 4205		3	186 51 22.2	1 15 29.7	1.642 8069
	5	147 16 28.3	1 50 00.5	1.663 8584		5	187 45 16.4	1 14 12.6	1.641 4656
	7	148 08 59.6	+1 49 46.3	1.664 2568		7	188 39 15.9	+1 12 54.3	1.640 0892
	9	149 01 29.5	1 49 30.7	1.664 6157		9	189 33 20.9	1 11 34.8	1.638 6780
	11	149 53 58.1	1 49 13.5	1.664 9351		11	190 27 31.4	1 10 14.1	1.637 2322
	13	150 46 25.5	1 48 54.7	1.665 2147		13	191 21 47.7	1 08 52.2	1.635 7522
	15	151 38 51.9	1 48 34.5	1.665 4547		15	192 16 09.9	1 07 29.1	1.634 2383
	17	152 31 17.5	1 48 12.8	1.665 6549		17	193 10 38.2	1 06 04.9	1.632 6907
	19	153 23 42.4	+1 47 49.5	1.665 8153		19	194 05 12.7	+1 04 39.5	1.631 1099
	21	154 16 06.7	1 47 24.8	1.665 9359		21	194 59 53.6	1 03 12.9	1.629 4960
	23	155 08 30.6	1 46 58.5	1.666 0167		23	195 54 41.0	1 01 45.2	1.627 8496
	25	156 00 54.2	1 46 30.8	1.666 0576		25	196 49 35.1	1 00 16.3	1.626 1709
	27	156 53 17.8	1 46 01.6	1.666 0587		27	197 44 35.9	0 58 46.4	1.624 4602
	29	157 45 41.3	1 45 30.9	1.666 0198		29	198 39 43.8	0 57 15.4	1.622 7181
	31	158 38 05.1	+1 44 58.8	1.665 9412	Dec.	1	199 34 58.8	+0 55 43.3	1.620 9448
Sept.	2	159 30 29.2	1 44 25.2	1.665 8226		3	200 30 21.0	0 54 10.1	1.619 1407
	4	160 22 53.8	1 43 50.1	1.665 6643		5	201 25 50.7	0 52 35.8	1.617 3063
	6	161 15 19.0	1 43 13.5	1.665 4661		7	202 21 28.0	0 51 00.5	1.615 4419
	8	162 07 45.1	1 42 35.6	1.665 2282		9	203 17 13.0	0 49 24.2	1.613 5480
	10	163 00 12.0	1 41 56.1	1.664 9506		11	204 13 05.8	0 47 46.9	1.611 6249
	12	163 52 40.1	+1 41 15.3	1.664 6333		13	205 09 06.7	+0 46 08.6	1.609 6733
	14	164 45 09.4	1 40 33.0	1.664 2764		15	206 05 15.8	0 44 29.3	1.607 6934
	16	165 37 40.0	1 39 49.2	1.663 8799		17	207 01 33.2	0 42 49.0	1.605 6857
	18	166 30 12.3	1 39 04.1	1.663 4440		19	207 57 59.1	0 41 07.9	1.603 6508
	20	167 22 46.1	1 38 17.5	1.662 9687		21	208 54 33.6	0 39 25.7	1.601 5891
	22	168 15 21.9	1 37 29.6	1.662 4541		23	209 51 16.8	0 37 42.7	1.599 5010
	24	169 07 59.6	+1 36 40.2	1.661 9003		25	210 48 09.0	+0 35 58.8	1.597 3872
	26	170 00 39.4	1 35 49.4	1.661 3074		27	211 45 10.2	0 34 14.0	1.595 2480
	28	170 53 21.6	1 34 57.3	1.660 6755		29	212 42 20.7	0 32 28.3	1.593 0841
	30	171 46 06.1	1 34 03.8	1.660 0048		31	213 39 40.5	0 30 41.9	1.590 8959
Oct.	2	172 38 53.3	+1 33 08.9	1.659 2952		33	214 37 09.8	+0 28 54.6	1.588 6841

MARS, 2019
GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Jan.	0	359	15	45.6	-0	19	16.1
	1	359	56	03.1	0	17	53.3
	2	0	36	22.5	0	16	31.5
	3	1	16	43.8	0	15	10.7
	4	1	57	06.9	0	13	50.9
	5	2	37	31.6	0	12	32.0
	6	3	17	57.9	-0	11	14.1
	7	3	58	25.8	0	09	57.2
	8	4	38	54.9	0	08	41.1
	9	5	19	25.4	0	07	26.0
	10	5	59	57.1	0	06	11.8
	11	6	40	29.8	0	04	58.5
	12	7	21	03.4	-0	03	46.1
	13	8	01	38.0	0	02	34.5
	14	8	42	13.3	0	01	23.8
	15	9	22	49.4	-0	00	14.0
	16	10	03	26.0	+0	00	55.1
	17	10	44	03.2	0	02	03.3
	18	11	24	40.8	+0	03	10.6
	19	12	05	18.7	0	04	17.2
	20	12	45	56.8	0	05	22.9
	21	13	26	35.0	0	06	27.8
	22	14	07	13.3	0	07	31.9
	23	14	47	51.6	0	08	35.2
	24	15	28	29.8	+0	09	37.7
	25	16	09	08.1	0	10	39.4
	26	16	49	46.3	0	11	40.2
	27	17	30	24.7	0	12	40.3
	28	18	11	03.1	0	13	39.6
	29	18	51	41.6	0	14	38.1
	30	19	32	20.2	+0	15	35.9
	31	20	12	58.8	0	16	32.8
Feb.	1	20	53	37.5	0	17	29.1
	2	21	34	16.1	0	18	24.6
	3	22	14	54.6	0	19	19.4
	4	22	55	33.0	0	20	13.4
	5	23	36	11.2	+0	21	06.8
	6	24	16	49.2	0	21	59.5
	7	24	57	26.8	0	22	51.4
	8	25	38	04.1	0	23	42.8
	9	26	18	41.0	0	24	33.4
	10	26	59	17.5	0	25	23.4
	11	27	39	53.4	+0	26	12.8
	12	28	20	28.7	0	27	01.5
	13	29	01	03.5	0	27	49.6
	14	29	41	37.6	0	28	37.1
	15	30	22	10.9	+0	29	24.0

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Feb.	15	30	22	10.9	+0	29	24.0
	16	31	02	43.4	0	30	10.2
	17	31	43	15.0	0	30	55.8
	18	32	23	45.6	0	31	40.8
	19	33	04	15.2	0	32	25.2
	20	33	44	43.7	0	33	09.0
	21	34	25	11.2	+0	33	52.2
	22	35	05	37.6	0	34	34.8
	23	35	46	03.1	0	35	16.7
	24	36	26	27.7	0	35	58.1
	25	37	06	51.4	0	36	38.8
	26	37	47	14.2	0	37	19.0
	27	38	27	36.2	+0	37	58.6
	28	39	07	57.3	0	38	37.7
Mar.	1	39	48	17.6	0	39	16.1
	2	40	28	37.0	0	39	54.1
	3	41	08	55.4	0	40	31.5
	4	41	49	13.0	0	41	08.3
	5	42	29	29.5	+0	41	44.7
	6	43	09	45.1	0	42	20.5
	7	43	49	59.7	0	42	55.8
	8	44	30	13.3	0	43	30.6
	9	45	10	25.9	0	44	05.0
	10	45	50	37.4	0	44	38.8
	11	46	30	47.8	+0	45	12.2
	12	47	10	57.1	0	45	45.1
	13	47	51	05.2	0	46	17.6
	14	48	31	12.1	0	46	49.6
	15	49	11	17.8	0	47	21.1
	16	49	51	22.1	0	47	52.1
	17	50	31	25.1	+0	48	22.7
	18	51	11	26.7	0	48	52.9
	19	51	51	26.7	0	49	22.5
	20	52	31	25.3	0	49	51.8
	21	53	11	22.4	0	50	20.5
	22	53	51	18.1	0	50	48.8
	23	54	31	12.4	+0	51	16.7
	24	55	11	05.4	0	51	44.1
	25	55	50	57.2	0	52	11.0
	26	56	30	47.7	0	52	37.5
	27	57	10	37.0	0	53	03.6
	28	57	50	25.1	0	53	29.3
	29	58	30	11.9	+0	53	54.5
	30	59	09	57.6	0	54	19.4
	31	59	49	42.0	0	54	43.8
Apr.	1	60	29	25.3	0	55	07.9
	2	61	09	07.3	+0	55	31.5

MARS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	60	29	25.3	+0	55	07.9	May	17	90	33	38.1	+1	07	30.3
	2	61	09	07.3	0	55	31.5		18	91	12	22.8	1	07	39.6
	3	61	48	48.1	0	55	54.8		19	91	51	06.3	1	07	48.6
	4	62	28	27.7	0	56	17.7		20	92	29	48.8	1	07	57.3
	5	63	08	06.1	0	56	40.3		21	93	08	30.3	1	08	05.8
	6	63	47	43.2	0	57	02.5		22	93	47	10.7	1	08	14.1
	7	64	27	19.2	+0	57	24.3		23	94	25	50.1	+1	08	22.1
	8	65	06	54.0	0	57	45.8		24	95	04	28.5	1	08	29.8
	9	65	46	27.5	0	58	06.9		25	95	43	05.9	1	08	37.3
	10	66	25	59.8	0	58	27.6		26	96	21	42.4	1	08	44.6
	11	67	05	30.7	0	58	48.1		27	97	00	18.0	1	08	51.7
	12	67	45	00.3	0	59	08.1		28	97	38	52.7	1	08	58.5
	13	68	24	28.5	+0	59	27.9		29	98	17	26.6	+1	09	05.1
	14	69	03	55.2	0	59	47.3		30	98	55	59.6	1	09	11.5
	15	69	43	20.4	1	00	06.3		31	99	34	31.9	1	09	17.7
	16	70	22	44.1	1	00	25.0	June	1	100	13	03.4	1	09	23.6
	17	71	02	06.3	1	00	43.3		2	100	51	34.2	1	09	29.4
	18	71	41	27.1	1	01	01.3		3	101	30	04.2	1	09	34.9
	19	72	20	46.4	+1	01	19.0		4	102	08	33.5	+1	09	40.3
	20	73	00	04.3	1	01	36.3		5	102	47	02.0	1	09	45.4
	21	73	39	20.9	1	01	53.2		6	103	25	29.7	1	09	50.3
	22	74	18	36.2	1	02	09.9		7	104	03	56.5	1	09	55.0
	23	74	57	50.2	1	02	26.2		8	104	42	22.4	1	09	59.5
	24	75	37	03.1	1	02	42.1		9	105	20	47.5	1	10	03.8
	25	76	16	14.6	+1	02	57.8		10	105	59	11.5	+1	10	07.8
	26	76	55	25.0	1	03	13.1		11	106	37	34.7	1	10	11.7
	27	77	34	34.2	1	03	28.1		12	107	15	56.9	1	10	15.3
	28	78	13	42.2	1	03	42.9		13	107	54	18.3	1	10	18.7
	29	78	52	49.0	1	03	57.3		14	108	32	38.9	1	10	21.9
	30	79	31	54.7	1	04	11.5		15	109	10	58.7	1	10	24.8
May	1	80	10	59.2	+1	04	25.3		16	109	49	17.8	+1	10	27.6
	2	80	50	02.7	1	04	38.9		17	110	27	36.1	1	10	30.1
	3	81	29	05.0	1	04	52.2		18	111	05	53.8	1	10	32.4
	4	82	08	06.3	1	05	05.2		19	111	44	10.7	1	10	34.6
	5	82	47	06.5	1	05	18.0		20	112	22	27.0	1	10	36.5
	6	83	26	05.7	1	05	30.5		21	113	00	42.7	1	10	38.2
	7	84	05	03.7	+1	05	42.7		22	113	38	57.7	+1	10	39.8
	8	84	44	00.7	1	05	54.7		23	114	17	12.2	1	10	41.1
	9	85	22	56.5	1	06	06.4		24	114	55	26.1	1	10	42.3
	10	86	01	51.1	1	06	17.8		25	115	33	39.5	1	10	43.3
	11	86	40	44.5	1	06	29.0		26	116	11	52.5	1	10	44.1
	12	87	19	36.7	1	06	39.9		27	116	50	05.1	1	10	44.7
	13	87	58	27.5	+1	06	50.5		28	117	28	17.3	+1	10	45.2
	14	88	37	17.0	1	07	00.8		29	118	06	29.2	1	10	45.5
	15	89	16	05.3	1	07	10.9		30	118	44	40.7	1	10	45.6
	16	89	54	52.3	1	07	20.7	July	1	119	22	51.9	1	10	45.5
	17	90	33	38.1	+1	07	30.3		2	120	01	02.8	+1	10	45.3

MARS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"	Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
July	1	119	22	51.9	+1	10	45.5	Aug.	16	148	35	20.1	+1	07	36.7
	2	120	01	02.8	1	10	45.3		17	149	13	26.3	1	07	28.8
	3	120	39	13.4	1	10	44.9		18	149	51	32.8	1	07	20.7
	4	121	17	23.5	1	10	44.3		19	150	29	39.6	1	07	12.5
	5	121	55	33.2	1	10	43.5		20	151	07	46.8	1	07	04.1
	6	122	33	42.5	1	10	42.6		21	151	45	54.5	1	06	55.6
	7	123	11	51.2	+1	10	41.4		22	152	24	02.6	+1	06	47.0
	8	123	49	59.5	1	10	40.1		23	153	02	11.2	1	06	38.2
	9	124	28	07.3	1	10	38.6		24	153	40	20.3	1	06	29.2
	10	125	06	14.7	1	10	36.9		25	154	18	30.0	1	06	20.1
	11	125	44	21.6	1	10	35.0		26	154	56	40.3	1	06	10.9
	12	126	22	28.2	1	10	33.0		27	155	34	51.1	1	06	01.5
	13	127	00	34.5	+1	10	30.7		28	156	13	02.4	+1	05	52.0
	14	127	38	40.4	1	10	28.3		29	156	51	14.2	1	05	42.3
	15	128	16	46.0	1	10	25.7		30	157	29	26.5	1	05	32.5
	16	128	54	51.4	1	10	22.9		31	158	07	39.2	1	05	22.5
	17	129	32	56.4	1	10	19.9	Sept.	1	158	45	52.3	1	05	12.4
	18	130	11	01.2	1	10	16.8		2	159	24	05.9	1	05	02.0
	19	130	49	05.8	+1	10	13.5		3	160	02	19.9	+1	04	51.5
	20	131	27	10.2	1	10	10.1		4	160	40	34.3	1	04	40.8
	21	132	05	14.4	1	10	06.5		5	161	18	49.4	1	04	29.9
	22	132	43	18.6	1	10	02.7		6	161	57	04.9	1	04	18.8
	23	133	21	22.7	1	09	58.8		7	162	35	20.9	1	04	07.6
	24	133	59	26.8	1	09	54.7		8	163	13	37.4	1	03	56.3
	25	134	37	30.9	+1	09	50.4		9	163	51	54.4	+1	03	44.8
	26	135	15	35.1	1	09	46.0		10	164	30	12.0	1	03	33.1
	27	135	53	39.3	1	09	41.5		11	165	08	30.0	1	03	21.3
	28	136	31	43.8	1	09	36.8		12	165	46	48.6	1	03	09.3
	29	137	09	48.3	1	09	31.9		13	166	25	07.8	1	02	57.2
	30	137	47	53.0	1	09	26.9		14	167	03	27.6	1	02	45.0
	31	138	25	57.8	+1	09	21.8		15	167	41	48.0	+1	02	32.6
Aug.	1	139	04	02.6	1	09	16.4		16	168	20	09.2	1	02	20.0
	2	139	42	07.4	1	09	11.0		17	168	58	31.2	1	02	07.3
	3	140	20	12.3	1	09	05.3		18	169	36	53.9	1	01	54.4
	4	140	58	17.1	1	08	59.5		19	170	15	17.5	1	01	41.4
	5	141	36	21.9	1	08	53.5		20	170	53	41.9	1	01	28.2
	6	142	14	26.8	+1	08	47.3		21	171	32	07.3	+1	01	14.9
	7	142	52	31.6	1	08	41.0		22	172	10	33.6	1	01	01.4
	8	143	30	36.6	1	08	34.5		23	172	49	00.8	1	00	47.8
	9	144	08	41.6	1	08	27.9		24	173	27	28.9	1	00	34.0
	10	144	46	46.7	1	08	21.0		25	174	05	57.9	1	00	20.1
	11	145	24	51.9	1	08	14.1		26	174	44	27.7	1	00	06.0
	12	146	02	57.3	+1	08	06.9		27	175	22	58.4	+0	59	51.7
	13	146	41	02.7	1	07	59.6		28	176	01	29.9	0	59	37.2
	14	147	19	08.3	1	07	52.1		29	176	40	02.3	0	59	22.6
	15	147	57	14.1	1	07	44.5		30	177	18	35.4	0	59	07.8
	16	148	35	20.1	+1	07	36.7	Oct.	1	177	57	09.5	+0	58	52.8

MARS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	177	57	09.5	+0	58	52.8	Nov.	16	207	49	05.9	+0	44	10.6
	2	178	35	44.3	0	58	37.7		17	208	28	29.8	0	43	46.8
	3	179	14	20.1	0	58	22.3		18	209	07	55.0	0	43	22.9
	4	179	52	56.6	0	58	06.8		19	209	47	21.5	0	42	58.7
	5	180	31	33.9	0	57	51.1		20	210	26	49.3	0	42	34.2
	6	181	10	12.1	0	57	35.3		21	211	06	18.4	0	42	09.6
	7	181	48	51.0	+0	57	19.3		22	211	45	48.7	+0	41	44.7
	8	182	27	30.8	0	57	03.1		23	212	25	20.4	0	41	19.6
	9	183	06	11.4	0	56	46.7		24	213	04	53.4	0	40	54.2
	10	183	44	52.8	0	56	30.2		25	213	44	27.7	0	40	28.6
	11	184	23	35.1	0	56	13.5		26	214	24	03.3	0	40	02.7
	12	185	02	18.3	0	55	56.7		27	215	03	40.1	0	39	36.6
	13	185	41	02.5	+0	55	39.7		28	215	43	18.1	+0	39	10.3
	14	186	19	47.7	0	55	22.5		29	216	22	57.3	0	38	43.7
	15	186	58	34.0	0	55	05.2		30	217	02	37.7	0	38	16.9
	16	187	37	21.3	0	54	47.6	Dec.	1	217	42	19.1	0	37	49.8
	17	188	16	09.8	0	54	29.9		2	218	22	01.6	0	37	22.5
	18	188	54	59.4	0	54	12.1		3	219	01	45.3	0	36	55.0
	19	189	33	50.2	+0	53	54.1		4	219	41	30.0	+0	36	27.2
	20	190	12	42.2	0	53	35.8		5	220	21	15.9	0	35	59.2
	21	190	51	35.4	0	53	17.5		6	221	01	02.9	0	35	31.0
	22	191	30	29.7	0	52	58.9		7	221	40	51.0	0	35	02.5
	23	192	09	25.2	0	52	40.1		8	222	20	40.4	0	34	33.7
	24	192	48	21.8	0	52	21.2		9	223	00	31.1	0	34	04.7
	25	193	27	19.6	+0	52	02.0		10	223	40	23.0	+0	33	35.5
	26	194	06	18.4	0	51	42.7		11	224	20	16.3	0	33	06.0
	27	194	45	18.4	0	51	23.1		12	225	00	10.9	0	32	36.3
	28	195	24	19.5	0	51	03.4		13	225	40	06.9	0	32	06.3
	29	196	03	21.7	0	50	43.4		14	226	20	04.2	0	31	36.0
	30	196	42	25.0	0	50	23.3		15	227	00	02.9	0	31	05.5
	31	197	21	29.5	+0	50	02.9		16	227	40	03.0	+0	30	34.7
Nov.	1	198	00	34.9	0	49	42.4		17	228	20	04.4	0	30	03.6
	2	198	39	41.4	0	49	21.7		18	229	00	07.2	0	29	32.2
	3	199	18	48.9	0	49	00.7		19	229	40	11.4	0	29	00.5
	4	199	57	57.4	0	48	39.6		20	230	20	16.9	0	28	28.5
	5	200	37	06.9	0	48	18.2		21	231	00	23.8	0	27	56.3
	6	201	16	17.4	+0	47	56.7		22	231	40	32.0	+0	27	23.7
	7	201	55	29.0	0	47	35.0		23	232	20	41.6	0	26	50.9
	8	202	34	41.7	0	47	13.1		24	233	00	52.6	0	26	17.7
	9	203	13	55.4	0	46	51.0		25	233	41	04.8	0	25	44.2
	10	203	53	10.3	0	46	28.7		26	234	21	18.2	0	25	10.5
	11	204	32	26.4	0	46	06.2		27	235	01	32.9	0	24	36.4
	12	205	11	43.7	+0	45	43.5		28	235	41	48.7	+0	24	02.1
	13	205	51	02.3	0	45	20.6		29	236	22	05.5	0	23	27.4
	14	206	30	22.2	0	44	57.4		30	237	02	23.5	0	22	52.5
	15	207	09	43.4	0	44	34.1		31	237	42	42.6	0	22	17.3
	16	207	49	05.9	+0	44	10.6		32	238	23	02.7	+0	21	41.7

MARS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	23	57	48.29	-0	35	16.4	1.252 595	7.02	3.74	17	19	14
	1	0	00	13.97	0	17	59.0	1.261 007	6.97	3.71	17	17	43
	2	0	02	39.79	-0	00	41.7	1.269 434	6.93	3.69	17	16	12
	3	0	05	05.75	+0	16	35.3	1.277 875	6.88	3.66	17	14	42
	4	0	07	31.86	0	33	51.8	1.286 331	6.84	3.64	17	13	12
	5	0	09	58.12	0	51	07.8	1.294 800	6.79	3.61	17	11	42
	6	0	12	24.52	+1	08	23.2	1.303 281	6.75	3.59	17	10	12
	7	0	14	51.07	1	25	37.7	1.311 775	6.70	3.57	17	08	42
	8	0	17	17.77	1	42	51.2	1.320 279	6.66	3.54	17	07	12
	9	0	19	44.62	2	00	03.7	1.328 795	6.62	3.52	17	05	43
	10	0	22	11.62	2	17	14.8	1.337 320	6.58	3.50	17	04	13
	11	0	24	38.76	2	34	24.7	1.345 854	6.53	3.48	17	02	44
	12	0	27	06.06	+2	51	33.0	1.354 397	6.49	3.46	17	01	15
	13	0	29	33.50	3	08	39.6	1.362 949	6.45	3.43	16	59	46
	14	0	32	01.10	3	25	44.4	1.371 508	6.41	3.41	16	58	17
	15	0	34	28.86	3	42	47.3	1.380 074	6.37	3.39	16	56	49
	16	0	36	56.76	3	59	48.1	1.388 647	6.33	3.37	16	55	20
	17	0	39	24.83	4	16	46.7	1.397 227	6.29	3.35	16	53	52
	18	0	41	53.04	+4	33	43.0	1.405 812	6.26	3.33	16	52	24
	19	0	44	21.42	4	50	36.7	1.414 404	6.22	3.31	16	50	56
	20	0	46	49.95	5	07	27.8	1.423 002	6.18	3.29	16	49	28
	21	0	49	18.64	5	24	16.1	1.431 605	6.14	3.27	16	48	00
	22	0	51	47.49	5	41	01.4	1.440 214	6.11	3.25	16	46	33
	23	0	54	16.50	5	57	43.7	1.448 829	6.07	3.23	16	45	06
	24	0	56	45.68	+6	14	22.8	1.457 450	6.03	3.21	16	43	38
	25	0	59	15.04	6	30	58.5	1.466 075	6.00	3.19	16	42	11
	26	1	01	44.58	6	47	30.9	1.474 706	5.96	3.17	16	40	45
	27	1	04	14.32	7	03	59.8	1.483 342	5.93	3.16	16	39	18
	28	1	06	44.25	7	20	25.1	1.491 981	5.89	3.14	16	37	52
	29	1	09	14.39	7	36	46.6	1.500 624	5.86	3.12	16	36	26
	30	1	11	44.74	+7	53	04.4	1.509 269	5.83	3.10	16	34	60
	31	1	14	15.31	8	09	18.3	1.517 917	5.79	3.08	16	33	34
Feb.	1	1	16	46.10	8	25	28.1	1.526 566	5.76	3.07	16	32	08
	2	1	19	17.11	8	41	33.8	1.535 216	5.73	3.05	16	30	43
	3	1	21	48.35	8	57	35.2	1.543 865	5.70	3.03	16	29	18
	4	1	24	19.81	9	13	32.2	1.552 513	5.66	3.01	16	27	53
	5	1	26	51.50	+9	29	24.6	1.561 160	5.63	3.00	16	26	28
	6	1	29	23.42	9	45	12.4	1.569 804	5.60	2.98	16	25	04
	7	1	31	55.57	10	00	55.4	1.578 446	5.57	2.96	16	23	40
	8	1	34	27.95	10	16	33.5	1.587 083	5.54	2.95	16	22	16
	9	1	37	00.58	10	32	06.6	1.595 716	5.51	2.93	16	20	52
	10	1	39	33.44	10	47	34.5	1.604 344	5.48	2.92	16	19	29
	11	1	42	06.54	+11	02	57.1	1.612 966	5.45	2.90	16	18	06
	12	1	44	39.88	11	18	14.3	1.621 581	5.42	2.89	16	16	43
	13	1	47	13.46	11	33	26.0	1.630 190	5.39	2.87	16	15	20
	14	1	49	47.29	11	48	32.0	1.638 792	5.37	2.86	16	13	57
	15	1	52	21.36	+12	03	32.1	1.647 387	5.34	2.84	16	12	35

MARS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	1	52	21.36	+12	03	32.1	1.647 387	5.34	2.84	16	12	35
	16	1	54	55.67	12	18	26.4	1.655 973	5.31	2.83	16	11	13
	17	1	57	30.22	12	33	14.6	1.664 551	5.28	2.81	16	09	51
	18	2	00	05.01	12	47	56.6	1.673 122	5.26	2.80	16	08	30
	19	2	02	40.05	13	02	32.2	1.681 683	5.23	2.78	16	07	09
	20	2	05	15.32	13	17	01.4	1.690 237	5.20	2.77	16	05	48
	21	2	07	50.85	+13	31	24.1	1.698 782	5.18	2.75	16	04	27
	22	2	10	26.62	13	45	40.0	1.707 319	5.15	2.74	16	03	06
	23	2	13	02.66	13	59	49.2	1.715 847	5.13	2.73	16	01	46
	24	2	15	38.97	14	13	51.5	1.724 365	5.10	2.71	16	00	26
	25	2	18	15.54	14	27	46.9	1.732 874	5.07	2.70	15	59	06
	26	2	20	52.40	14	41	35.3	1.741 372	5.05	2.69	15	57	47
	27	2	23	29.53	+14	55	16.5	1.749 860	5.03	2.67	15	56	28
	28	2	26	06.94	15	08	50.5	1.758 336	5.00	2.66	15	55	09
Mar.	1	2	28	44.64	15	22	17.2	1.766 799	4.98	2.65	15	53	50
	2	2	31	22.61	15	35	36.4	1.775 249	4.95	2.64	15	52	32
	3	2	34	00.88	15	48	48.1	1.783 686	4.93	2.62	15	51	14
	4	2	36	39.43	16	01	52.2	1.792 108	4.91	2.61	15	49	56
	5	2	39	18.26	+16	14	48.5	1.800 515	4.88	2.60	15	48	39
	6	2	41	57.38	16	27	36.9	1.808 906	4.86	2.59	15	47	21
	7	2	44	36.78	16	40	17.4	1.817 280	4.84	2.58	15	46	05
	8	2	47	16.47	16	52	49.8	1.825 637	4.82	2.56	15	44	48
	9	2	49	56.44	17	05	13.9	1.833 975	4.80	2.55	15	43	32
	10	2	52	36.70	17	17	29.8	1.842 295	4.77	2.54	15	42	16
	11	2	55	17.24	+17	29	37.3	1.850 595	4.75	2.53	15	40	60
	12	2	57	58.07	17	41	36.3	1.858 875	4.73	2.52	15	39	44
	13	3	00	39.17	17	53	26.7	1.867 135	4.71	2.51	15	38	29
	14	3	03	20.55	18	05	08.4	1.875 374	4.69	2.50	15	37	14
	15	3	06	02.20	18	16	41.2	1.883 591	4.67	2.48	15	35	60
	16	3	08	44.12	18	28	05.2	1.891 787	4.65	2.47	15	34	45
	17	3	11	26.31	+18	39	20.1	1.899 961	4.63	2.46	15	33	31
	18	3	14	08.75	18	50	25.8	1.908 112	4.61	2.45	15	32	17
	19	3	16	51.45	19	01	22.3	1.916 242	4.59	2.44	15	31	03
	20	3	19	34.40	19	12	09.5	1.924 349	4.57	2.43	15	29	50
	21	3	22	17.61	19	22	47.1	1.932 434	4.55	2.42	15	28	37
	22	3	25	01.07	19	33	15.3	1.940 497	4.53	2.41	15	27	24
	23	3	27	44.79	+19	43	33.8	1.948 537	4.51	2.40	15	26	12
	24	3	30	28.78	19	53	42.7	1.956 555	4.49	2.39	15	24	59
	25	3	33	13.02	20	03	41.8	1.964 549	4.48	2.38	15	23	47
	26	3	35	57.52	20	13	31.1	1.972 520	4.46	2.37	15	22	35
	27	3	38	42.28	20	23	10.5	1.980 466	4.44	2.36	15	21	24
	28	3	41	27.30	20	32	40.0	1.988 388	4.42	2.35	15	20	12
	29	3	44	12.57	+20	41	59.5	1.996 284	4.41	2.34	15	19	01
	30	3	46	58.09	20	51	08.9	2.004 155	4.39	2.34	15	17	51
	31	3	49	43.86	21	00	08.0	2.011 998	4.37	2.33	15	16	40
Apr.	1	3	52	29.87	21	08	57.0	2.019 815	4.35	2.32	15	15	30
	2	3	55	16.13	+21	17	35.5	2.027 603	4.34	2.31	15	14	20

MARS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	3	52	29.87	+21	08	57.0	2.019 815	4.35	2.32	15	15	30
	2	3	55	16.13	21	17	35.5	2.027 603	4.34	2.31	15	14	20
	3	3	58	02.62	21	26	03.7	2.035 362	4.32	2.30	15	13	10
	4	4	00	49.34	21	34	21.4	2.043 092	4.30	2.29	15	12	00
	5	4	03	36.29	21	42	28.6	2.050 792	4.29	2.28	15	10	51
	6	4	06	23.46	21	50	25.1	2.058 461	4.27	2.27	15	09	41
	7	4	09	10.86	+21	58	10.9	2.066 099	4.26	2.27	15	08	33
	8	4	11	58.46	22	05	46.0	2.073 704	4.24	2.26	15	07	24
	9	4	14	46.28	22	13	10.2	2.081 277	4.23	2.25	15	06	15
	10	4	17	34.29	22	20	23.6	2.088 816	4.21	2.24	15	05	07
	11	4	20	22.50	22	27	26.1	2.096 322	4.20	2.23	15	03	59
	12	4	23	10.89	22	34	17.5	2.103 794	4.18	2.22	15	02	51
	13	4	25	59.45	+22	40	57.9	2.111 232	4.17	2.22	15	01	43
	14	4	28	48.18	22	47	27.2	2.118 635	4.15	2.21	15	00	35
	15	4	31	37.06	22	53	45.2	2.126 004	4.14	2.20	14	59	28
	16	4	34	26.09	22	59	52.0	2.133 338	4.12	2.19	14	58	20
	17	4	37	15.26	23	05	47.4	2.140 637	4.11	2.19	14	57	13
	18	4	40	04.57	23	11	31.5	2.147 902	4.09	2.18	14	56	06
	19	4	42	54.01	+23	17	04.2	2.155 132	4.08	2.17	14	54	59
	20	4	45	43.58	23	22	25.4	2.162 327	4.07	2.16	14	53	52
	21	4	48	33.28	23	27	35.2	2.169 487	4.05	2.16	14	52	45
	22	4	51	23.10	23	32	33.4	2.176 612	4.04	2.15	14	51	39
	23	4	54	13.04	23	37	20.2	2.183 702	4.03	2.14	14	50	32
	24	4	57	03.09	23	41	55.4	2.190 756	4.01	2.14	14	49	26
	25	4	59	53.24	+23	46	19.0	2.197 773	4.00	2.13	14	48	20
	26	5	02	43.49	23	50	31.1	2.204 754	3.99	2.12	14	47	13
	27	5	05	33.84	23	54	31.5	2.211 697	3.98	2.12	14	46	07
	28	5	08	24.26	23	58	20.3	2.218 602	3.96	2.11	14	45	01
	29	5	11	14.77	24	01	57.4	2.225 468	3.95	2.10	14	43	55
	30	5	14	05.34	24	05	22.9	2.232 295	3.94	2.10	14	42	49
May	1	5	16	55.98	+24	08	36.6	2.239 083	3.93	2.09	14	41	44
	2	5	19	46.67	24	11	38.5	2.245 829	3.92	2.08	14	40	38
	3	5	22	37.42	24	14	28.8	2.252 535	3.90	2.08	14	39	32
	4	5	25	28.21	24	17	07.2	2.259 199	3.89	2.07	14	38	26
	5	5	28	19.03	24	19	33.9	2.265 821	3.88	2.07	14	37	21
	6	5	31	09.88	24	21	48.8	2.272 400	3.87	2.06	14	36	15
	7	5	34	00.75	+24	23	51.9	2.278 935	3.86	2.05	14	35	09
	8	5	36	51.62	24	25	43.2	2.285 426	3.85	2.05	14	34	04
	9	5	39	42.49	24	27	22.8	2.291 873	3.84	2.04	14	32	58
	10	5	42	33.34	24	28	50.6	2.298 275	3.83	2.04	14	31	52
	11	5	45	24.15	24	30	06.6	2.304 632	3.82	2.03	14	30	47
	12	5	48	14.93	24	31	10.8	2.310 944	3.81	2.03	14	29	41
	13	5	51	05.66	+24	32	03.2	2.317 211	3.80	2.02	14	28	35
	14	5	53	56.33	24	32	43.9	2.323 432	3.78	2.01	14	27	29
	15	5	56	46.93	24	33	12.7	2.329 608	3.77	2.01	14	26	23
	16	5	59	37.45	24	33	29.7	2.335 739	3.77	2.00	14	25	17
	17	6	02	27.90	+24	33	35.0	2.341 825	3.76	2.00	14	24	11

MARS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	6	02	27.90	+24	33	35.0	2.341 825	3.76	2.00	14	24	11
	18	6	05	18.26	24	33	28.6	2.347 866	3.75	1.99	14	23	05
	19	6	08	08.53	24	33	10.4	2.353 861	3.74	1.99	14	21	59
	20	6	10	58.70	24	32	40.6	2.359 811	3.73	1.98	14	20	52
	21	6	13	48.77	24	31	59.2	2.365 716	3.72	1.98	14	19	46
	22	6	16	38.73	24	31	06.1	2.371 575	3.71	1.97	14	18	39
	23	6	19	28.57	+24	30	01.5	2.377 388	3.70	1.97	14	17	32
	24	6	22	18.28	24	28	45.3	2.383 154	3.69	1.96	14	16	26
	25	6	25	07.87	24	27	17.6	2.388 874	3.68	1.96	14	15	19
	26	6	27	57.32	24	25	38.5	2.394 546	3.67	1.95	14	14	11
	27	6	30	46.62	24	23	47.9	2.400 170	3.66	1.95	14	13	04
	28	6	33	35.77	24	21	45.8	2.405 745	3.66	1.95	14	11	57
	29	6	36	24.77	+24	19	32.4	2.411 272	3.65	1.94	14	10	49
	30	6	39	13.60	24	17	07.7	2.416 749	3.64	1.94	14	09	41
	31	6	42	02.27	24	14	31.6	2.422 176	3.63	1.93	14	08	33
June	1	6	44	50.77	24	11	44.3	2.427 553	3.62	1.93	14	07	25
	2	6	47	39.08	24	08	45.8	2.432 878	3.61	1.92	14	06	17
	3	6	50	27.21	24	05	36.1	2.438 151	3.61	1.92	14	05	09
	4	6	53	15.15	+24	02	15.4	2.443 372	3.60	1.92	14	03	60
	5	6	56	02.88	23	58	43.6	2.448 540	3.59	1.91	14	02	51
	6	6	58	50.40	23	55	00.8	2.453 655	3.58	1.91	14	01	42
	7	7	01	37.69	23	51	07.2	2.458 716	3.58	1.90	14	00	32
	8	7	04	24.75	23	47	02.7	2.463 724	3.57	1.90	13	59	23
	9	7	07	11.56	23	42	47.3	2.468 677	3.56	1.90	13	58	13
	10	7	09	58.13	+23	38	21.3	2.473 577	3.56	1.89	13	57	03
	11	7	12	44.44	23	33	44.5	2.478 423	3.55	1.89	13	55	53
	12	7	15	30.49	23	28	57.1	2.483 215	3.54	1.88	13	54	42
	13	7	18	16.27	23	23	59.0	2.487 953	3.53	1.88	13	53	31
	14	7	21	01.79	23	18	50.5	2.492 637	3.53	1.88	13	52	20
	15	7	23	47.04	23	13	31.6	2.497 269	3.52	1.87	13	51	09
	16	7	26	32.02	+23	08	02.3	2.501 846	3.52	1.87	13	49	57
	17	7	29	16.72	23	02	22.7	2.506 370	3.51	1.87	13	48	45
	18	7	32	01.13	22	56	32.9	2.510 841	3.50	1.86	13	47	33
	19	7	34	45.27	22	50	33.0	2.515 257	3.50	1.86	13	46	20
	20	7	37	29.11	22	44	23.0	2.519 620	3.49	1.86	13	45	07
	21	7	40	12.67	22	38	03.0	2.523 929	3.48	1.85	13	43	54
	22	7	42	55.93	+22	31	33.2	2.528 182	3.48	1.85	13	42	41
	23	7	45	38.89	22	24	53.5	2.532 381	3.47	1.85	13	41	27
	24	7	48	21.56	22	18	04.0	2.536 525	3.47	1.85	13	40	13
	25	7	51	03.93	22	11	04.8	2.540 613	3.46	1.84	13	38	59
	26	7	53	46.00	22	03	56.0	2.544 644	3.46	1.84	13	37	44
	27	7	56	27.78	21	56	37.7	2.548 619	3.45	1.84	13	36	29
	28	7	59	09.24	+21	49	09.8	2.552 537	3.45	1.83	13	35	14
	29	8	01	50.41	21	41	32.6	2.556 397	3.44	1.83	13	33	59
	30	8	04	31.27	21	33	46.1	2.560 199	3.43	1.83	13	32	43
July	1	8	07	11.82	21	25	50.4	2.563 942	3.43	1.83	13	31	27
	2	8	09	52.07	+21	17	45.5	2.567 626	3.43	1.82	13	30	10

MARS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	8	07	11.82	+21	25	50.4	2.563 942	3.43	1.83	13	31	27
	2	8	09	52.07	21	17	45.5	2.567 626	3.43	1.82	13	30	10
	3	8	12	32.00	21	09	31.6	2.571 250	3.42	1.82	13	28	54
	4	8	15	11.61	21	01	08.8	2.574 814	3.42	1.82	13	27	37
	5	8	17	50.89	20	52	37.1	2.578 317	3.41	1.82	13	26	19
	6	8	20	29.84	20	43	56.7	2.581 760	3.41	1.81	13	25	01
	7	8	23	08.46	+20	35	07.7	2.585 142	3.40	1.81	13	23	43
	8	8	25	46.74	20	26	10.0	2.588 464	3.40	1.81	13	22	25
	9	8	28	24.68	20	17	03.8	2.591 724	3.39	1.81	13	21	06
	10	8	31	02.29	20	07	49.3	2.594 924	3.39	1.80	13	19	47
	11	8	33	39.57	19	58	26.3	2.598 064	3.38	1.80	13	18	28
	12	8	36	16.51	19	48	55.2	2.601 144	3.38	1.80	13	17	08
	13	8	38	53.12	+19	39	15.9	2.604 164	3.38	1.80	13	15	48
	14	8	41	29.40	19	29	28.6	2.607 123	3.37	1.80	13	14	28
	15	8	44	05.34	19	19	33.3	2.610 023	3.37	1.79	13	13	07
	16	8	46	40.96	19	09	30.2	2.612 863	3.37	1.79	13	11	46
	17	8	49	16.24	18	59	19.3	2.615 643	3.36	1.79	13	10	25
	18	8	51	51.20	18	49	00.8	2.618 363	3.36	1.79	13	09	03
	19	8	54	25.83	+18	38	34.7	2.621 023	3.36	1.79	13	07	41
	20	8	57	00.13	18	28	01.1	2.623 623	3.35	1.78	13	06	18
	21	8	59	34.12	18	17	20.1	2.626 162	3.35	1.78	13	04	56
	22	9	02	07.79	18	06	31.7	2.628 639	3.35	1.78	13	03	33
	23	9	04	41.14	17	55	36.1	2.631 056	3.34	1.78	13	02	10
	24	9	07	14.18	17	44	33.4	2.633 411	3.34	1.78	13	00	46
	25	9	09	46.92	+17	33	23.6	2.635 704	3.34	1.78	12	59	22
	26	9	12	19.35	17	22	06.7	2.637 935	3.33	1.77	12	57	58
	27	9	14	51.49	17	10	43.0	2.640 103	3.33	1.77	12	56	33
	28	9	17	23.32	16	59	12.5	2.642 208	3.33	1.77	12	55	09
	29	9	19	54.86	16	47	35.3	2.644 249	3.33	1.77	12	53	43
	30	9	22	26.11	16	35	51.5	2.646 226	3.32	1.77	12	52	18
	31	9	24	57.07	+16	24	01.2	2.648 138	3.32	1.77	12	50	52
Aug.	1	9	27	27.73	16	12	04.5	2.649 985	3.32	1.77	12	49	26
	2	9	29	58.09	16	00	01.5	2.651 766	3.32	1.76	12	48	00
	3	9	32	28.15	15	47	52.3	2.653 482	3.31	1.76	12	46	34
	4	9	34	57.93	15	35	37.0	2.655 133	3.31	1.76	12	45	07
	5	9	37	27.40	15	23	15.7	2.656 718	3.31	1.76	12	43	40
	6	9	39	56.60	+15	10	48.4	2.658 237	3.31	1.76	12	42	12
	7	9	42	25.50	14	58	15.4	2.659 691	3.31	1.76	12	40	44
	8	9	44	54.13	14	45	36.6	2.661 080	3.30	1.76	12	39	16
	9	9	47	22.48	14	32	52.1	2.662 405	3.30	1.76	12	37	48
	10	9	49	50.56	14	20	02.1	2.663 665	3.30	1.76	12	36	20
	11	9	52	18.37	14	07	06.7	2.664 860	3.30	1.76	12	34	51
	12	9	54	45.92	+13	54	06.0	2.665 991	3.30	1.76	12	33	22
	13	9	57	13.21	13	41	00.0	2.667 059	3.30	1.75	12	31	53
	14	9	59	40.24	13	27	48.9	2.668 062	3.30	1.75	12	30	23
	15	10	02	07.02	13	14	32.7	2.669 001	3.29	1.75	12	28	53
	16	10	04	33.55	+13	01	11.5	2.669 876	3.29	1.75	12	27	23

MARS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	10	04	33.55	+13	01	11.5	2.669 876	3.29	1.75	12	27	23
	17	10	06	59.84	12	47	45.4	2.670 686	3.29	1.75	12	25	53
	18	10	09	25.90	12	34	14.5	2.671 433	3.29	1.75	12	24	22
	19	10	11	51.74	12	20	38.9	2.672 115	3.29	1.75	12	22	52
	20	10	14	17.35	12	06	58.6	2.672 732	3.29	1.75	12	21	21
	21	10	16	42.75	11	53	13.8	2.673 285	3.29	1.75	12	19	49
	22	10	19	07.94	+11	39	24.5	2.673 772	3.29	1.75	12	18	18
	23	10	21	32.93	11	25	30.7	2.674 194	3.29	1.75	12	16	47
	24	10	23	57.72	11	11	32.7	2.674 550	3.29	1.75	12	15	15
	25	10	26	22.33	10	57	30.4	2.674 840	3.29	1.75	12	13	43
	26	10	28	46.75	10	43	24.0	2.675 063	3.29	1.75	12	12	11
	27	10	31	11.00	10	29	13.5	2.675 220	3.29	1.75	12	10	38
	28	10	33	35.06	+10	14	59.1	2.675 309	3.29	1.75	12	09	06
	29	10	35	58.95	10	00	41.0	2.675 330	3.29	1.75	12	07	33
	30	10	38	22.66	9	46	19.0	2.675 283	3.29	1.75	12	06	00
	31	10	40	46.20	9	31	53.5	2.675 169	3.29	1.75	12	04	27
Sept.	1	10	43	09.57	9	17	24.5	2.674 986	3.29	1.75	12	02	54
	2	10	45	32.78	9	02	51.9	2.674 734	3.29	1.75	12	01	21
	3	10	47	55.83	+8	48	16.0	2.674 415	3.29	1.75	11	59	47
	4	10	50	18.73	8	33	36.8	2.674 029	3.29	1.75	11	58	14
	5	10	52	41.49	8	18	54.4	2.673 574	3.29	1.75	11	56	40
	6	10	55	04.11	8	04	08.9	2.673 053	3.29	1.75	11	55	06
	7	10	57	26.59	7	49	20.5	2.672 466	3.29	1.75	11	53	32
	8	10	59	48.95	7	34	29.2	2.671 811	3.29	1.75	11	51	58
	9	11	02	11.18	+7	19	35.1	2.671 091	3.29	1.75	11	50	24
	10	11	04	33.29	7	04	38.3	2.670 305	3.29	1.75	11	48	49
	11	11	06	55.29	6	49	38.9	2.669 453	3.29	1.75	11	47	15
	12	11	09	17.19	6	34	37.0	2.668 535	3.30	1.75	11	45	40
	13	11	11	38.98	6	19	32.7	2.667 552	3.30	1.75	11	44	05
	14	11	14	00.69	6	04	26.0	2.666 503	3.30	1.76	11	42	31
	15	11	16	22.31	+5	49	17.1	2.665 389	3.30	1.76	11	40	56
	16	11	18	43.86	5	34	05.9	2.664 210	3.30	1.76	11	39	21
	17	11	21	05.34	5	18	52.7	2.662 965	3.30	1.76	11	37	46
	18	11	23	26.76	5	03	37.3	2.661 654	3.30	1.76	11	36	11
	19	11	25	48.13	4	48	20.1	2.660 278	3.31	1.76	11	34	36
	20	11	28	09.46	4	33	00.9	2.658 836	3.31	1.76	11	33	01
	21	11	30	30.75	+4	17	40.0	2.657 327	3.31	1.76	11	31	25
	22	11	32	52.02	4	02	17.3	2.655 753	3.31	1.76	11	29	50
	23	11	35	13.25	3	46	53.0	2.654 112	3.31	1.76	11	28	15
	24	11	37	34.47	3	31	27.2	2.652 404	3.32	1.76	11	26	40
	25	11	39	55.67	3	16	00.0	2.650 628	3.32	1.77	11	25	05
	26	11	42	16.86	3	00	31.5	2.648 786	3.32	1.77	11	23	29
	27	11	44	38.04	+2	45	01.8	2.646 875	3.32	1.77	11	21	54
	28	11	46	59.22	2	29	30.9	2.644 897	3.32	1.77	11	20	19
	29	11	49	20.40	2	13	59.0	2.642 851	3.33	1.77	11	18	43
	30	11	51	41.59	1	58	26.2	2.640 738	3.33	1.77	11	17	08
Oct.	1	11	54	02.80	+1	42	52.6	2.638 557	3.33	1.77	11	15	33

MARS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	11	54	02.80	+1	42	52.6	2.638 557	3.33	1.77	11	15	33
	2	11	56	24.03	1	27	18.2	2.636 308	3.34	1.78	11	13	58
	3	11	58	45.28	1	11	43.1	2.633 994	3.34	1.78	11	12	23
	4	12	01	06.56	0	56	07.6	2.631 613	3.34	1.78	11	10	47
	5	12	03	27.88	0	40	31.5	2.629 166	3.34	1.78	11	09	12
	6	12	05	49.25	0	24	55.2	2.626 654	3.35	1.78	11	07	37
	7	12	08	10.66	+0	09	18.6	2.624 077	3.35	1.78	11	06	02
	8	12	10	32.12	-0	06	18.1	2.621 435	3.35	1.79	11	04	27
	9	12	12	53.64	0	21	54.9	2.618 729	3.36	1.79	11	02	52
	10	12	15	15.23	0	37	31.6	2.615 959	3.36	1.79	11	01	18
	11	12	17	36.90	0	53	08.2	2.613 125	3.37	1.79	10	59	43
	12	12	19	58.65	1	08	44.5	2.610 228	3.37	1.79	10	58	08
	13	12	22	20.49	-1	24	20.6	2.607 268	3.37	1.79	10	56	34
	14	12	24	42.43	1	39	56.3	2.604 245	3.38	1.80	10	54	59
	15	12	27	04.48	1	55	31.6	2.601 159	3.38	1.80	10	53	25
	16	12	29	26.65	2	11	06.3	2.598 009	3.38	1.80	10	51	51
	17	12	31	48.94	2	26	40.4	2.594 798	3.39	1.80	10	50	17
	18	12	34	11.37	2	42	13.8	2.591 523	3.39	1.81	10	48	43
	19	12	36	33.93	-2	57	46.3	2.588 185	3.40	1.81	10	47	09
	20	12	38	56.64	3	13	18.0	2.584 785	3.40	1.81	10	45	35
	21	12	41	19.51	3	28	48.7	2.581 321	3.41	1.81	10	44	02
	22	12	43	42.52	3	44	18.3	2.577 794	3.41	1.82	10	42	28
	23	12	46	05.70	3	59	46.7	2.574 203	3.42	1.82	10	40	55
	24	12	48	29.05	4	15	13.8	2.570 550	3.42	1.82	10	39	22
	25	12	50	52.57	-4	30	39.5	2.566 832	3.43	1.82	10	37	49
	26	12	53	16.26	4	46	03.6	2.563 051	3.43	1.83	10	36	16
	27	12	55	40.13	5	01	26.2	2.559 206	3.44	1.83	10	34	44
	28	12	58	04.20	5	16	47.0	2.555 298	3.44	1.83	10	33	12
	29	13	00	28.45	5	32	05.9	2.551 327	3.45	1.83	10	31	39
	30	13	02	52.91	5	47	23.0	2.547 293	3.45	1.84	10	30	08
	31	13	05	17.57	-6	02	38.0	2.543 197	3.46	1.84	10	28	36
Nov.	1	13	07	42.43	6	17	50.8	2.539 040	3.46	1.84	10	27	04
	2	13	10	07.51	6	33	01.4	2.534 821	3.47	1.85	10	25	33
	3	13	12	32.79	6	48	09.6	2.530 543	3.48	1.85	10	24	02
	4	13	14	58.30	7	03	15.3	2.526 204	3.48	1.85	10	22	31
	5	13	17	24.04	7	18	18.3	2.521 806	3.49	1.86	10	21	00
	6	13	19	50.00	-7	33	18.7	2.517 349	3.49	1.86	10	19	30
	7	13	22	16.21	7	48	16.3	2.512 835	3.50	1.86	10	17	60
	8	13	24	42.66	8	03	10.9	2.508 262	3.51	1.87	10	16	30
	9	13	27	09.36	8	18	02.6	2.503 632	3.51	1.87	10	15	00
	10	13	29	36.33	8	32	51.1	2.498 945	3.52	1.87	10	13	31
	11	13	32	03.57	8	47	36.5	2.494 201	3.53	1.88	10	12	02
	12	13	34	31.08	-9	02	18.6	2.489 401	3.53	1.88	10	10	33
	13	13	36	58.88	9	16	57.3	2.484 546	3.54	1.88	10	09	05
	14	13	39	26.96	9	31	32.5	2.479 634	3.55	1.89	10	07	36
	15	13	41	55.35	9	46	04.2	2.474 667	3.55	1.89	10	06	08
	16	13	44	24.04	-10	00	32.2	2.469 645	3.56	1.90	10	04	41

MARS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	13	44	24.04	-10	00	32.2	2.469 645	3.56	1.90	10	04	41
	17	13	46	53.04	10	14	56.4	2.464 567	3.57	1.90	10	03	13
	18	13	49	22.35	10	29	16.7	2.459 434	3.58	1.90	10	01	46
	19	13	51	51.98	10	43	33.1	2.454 245	3.58	1.91	10	00	20
	20	13	54	21.93	10	57	45.3	2.449 001	3.59	1.91	9	58	53
	21	13	56	52.20	11	11	53.3	2.443 702	3.60	1.92	9	57	27
	22	13	59	22.80	-11	25	57.0	2.438 348	3.61	1.92	9	56	01
	23	14	01	53.74	11	39	56.2	2.432 939	3.61	1.92	9	54	36
	24	14	04	25.02	11	53	50.8	2.427 474	3.62	1.93	9	53	11
	25	14	06	56.64	12	07	40.7	2.421 955	3.63	1.93	9	51	46
	26	14	09	28.60	12	21	25.8	2.416 382	3.64	1.94	9	50	22
	27	14	12	00.92	12	35	06.0	2.410 755	3.65	1.94	9	48	58
	28	14	14	33.58	-12	48	41.1	2.405 076	3.66	1.95	9	47	34
	29	14	17	06.60	13	02	11.1	2.399 343	3.67	1.95	9	46	11
	30	14	19	39.96	13	15	35.7	2.393 559	3.67	1.96	9	44	48
Dec.	1	14	22	13.69	13	28	54.9	2.387 724	3.68	1.96	9	43	25
	2	14	24	47.77	13	42	08.6	2.381 839	3.69	1.96	9	42	03
	3	14	27	22.21	13	55	16.6	2.375 904	3.70	1.97	9	40	41
	4	14	29	57.01	-14	08	18.8	2.369 921	3.71	1.97	9	39	20
	5	14	32	32.19	14	21	15.1	2.363 889	3.72	1.98	9	37	58
	6	14	35	07.74	14	34	05.3	2.357 809	3.73	1.98	9	36	38
	7	14	37	43.67	14	46	49.5	2.351 683	3.74	1.99	9	35	17
	8	14	40	19.99	14	59	27.4	2.345 511	3.75	2.00	9	33	57
	9	14	42	56.70	15	11	59.0	2.339 293	3.76	2.00	9	32	38
	10	14	45	33.80	-15	24	24.1	2.333 029	3.77	2.01	9	31	18
	11	14	48	11.30	15	36	42.7	2.326 721	3.78	2.01	9	29	60
	12	14	50	49.21	15	48	54.7	2.320 369	3.79	2.02	9	28	41
	13	14	53	27.52	16	00	60.0	2.313 973	3.80	2.02	9	27	23
	14	14	56	06.24	16	12	58.3	2.307 533	3.81	2.03	9	26	06
	15	14	58	45.38	16	24	49.8	2.301 050	3.82	2.03	9	24	48
	16	15	01	24.93	-16	36	34.1	2.294 524	3.83	2.04	9	23	32
	17	15	04	04.89	16	48	11.2	2.287 955	3.84	2.05	9	22	15
	18	15	06	45.26	16	59	41.0	2.281 343	3.85	2.05	9	20	59
	19	15	09	26.06	17	11	03.4	2.274 689	3.87	2.06	9	19	44
	20	15	12	07.27	17	22	18.1	2.267 991	3.88	2.06	9	18	29
	21	15	14	48.90	17	33	25.2	2.261 252	3.89	2.07	9	17	14
	22	15	17	30.96	-17	44	24.5	2.254 471	3.90	2.08	9	15	60
	23	15	20	13.43	17	55	15.9	2.247 648	3.91	2.08	9	14	46
	24	15	22	56.33	18	05	59.2	2.240 783	3.92	2.09	9	13	32
	25	15	25	39.64	18	16	34.4	2.233 879	3.94	2.10	9	12	19
	26	15	28	23.36	18	27	01.3	2.226 934	3.95	2.10	9	11	07
	27	15	31	07.49	18	37	19.7	2.219 951	3.96	2.11	9	09	55
	28	15	33	52.03	-18	47	29.7	2.212 929	3.97	2.11	9	08	43
	29	15	36	36.97	18	57	31.0	2.205 870	3.99	2.12	9	07	31
	30	15	39	22.32	19	07	23.5	2.198 774	4.00	2.13	9	06	20
	31	15	42	08.06	19	17	07.1	2.191 642	4.01	2.14	9	05	10
	32	15	44	54.20	-19	26	41.7	2.184 475	4.03	2.14	9	03	59

JUPITER, 2019

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ′ ″	° ′ ″			° ′ ″	° ′ ″	
Jan. 1	246 45 05.6	+0 43 38.3	5.349 917	Apr. 3	254 00 46.4	+0 35 05.4	5.321 836
3	246 54 31.0	0 43 27.6	5.349 333	5	254 10 17.8	0 34 53.8	5.321 199
5	247 03 56.5	0 43 16.9	5.348 748	7	254 19 49.3	0 34 42.2	5.320 562
7	247 13 22.1	0 43 06.2	5.348 161	9	254 29 21.0	0 34 30.5	5.319 923
9	247 22 47.9	0 42 55.4	5.347 573	11	254 38 52.8	0 34 18.8	5.319 284
11	247 32 13.8	0 42 44.6	5.346 984	13	254 48 24.7	0 34 07.1	5.318 644
13	247 41 39.9	+0 42 33.9	5.346 394	15	254 57 56.8	+0 33 55.4	5.318 002
15	247 51 06.0	0 42 23.1	5.345 802	17	255 07 29.0	0 33 43.7	5.317 360
17	248 00 32.3	0 42 12.3	5.345 210	19	255 17 01.3	0 33 31.9	5.316 716
19	248 09 58.7	0 42 01.4	5.344 616	21	255 26 33.8	0 33 20.2	5.316 072
21	248 19 25.2	0 41 50.5	5.344 020	23	255 36 06.4	0 33 08.4	5.315 426
23	248 28 51.9	0 41 39.6	5.343 424	25	255 45 39.2	0 32 56.6	5.314 780
25	248 38 18.6	+0 41 28.7	5.342 827	27	255 55 12.1	+0 32 44.8	5.314 132
27	248 47 45.6	0 41 17.8	5.342 228	29	256 04 45.1	0 32 32.9	5.313 484
29	248 57 12.6	0 41 06.8	5.341 628	May 1	256 14 18.3	0 32 21.1	5.312 834
31	249 06 39.8	0 40 55.8	5.341 027	3	256 23 51.6	0 32 09.2	5.312 184
Feb. 2	249 16 07.1	0 40 44.8	5.340 425	5	256 33 25.1	0 31 57.3	5.311 533
4	249 25 34.5	0 40 33.8	5.339 822	7	256 42 58.6	0 31 45.4	5.310 880
6	249 35 02.0	+0 40 22.8	5.339 217	9	256 52 32.4	+0 31 33.5	5.310 227
8	249 44 29.7	0 40 11.7	5.338 611	11	257 02 06.3	0 31 21.5	5.309 573
10	249 53 57.5	0 40 00.6	5.338 005	13	257 11 40.3	0 31 09.5	5.308 918
12	250 03 25.4	0 39 49.5	5.337 397	15	257 21 14.5	0 30 57.6	5.308 262
14	250 12 53.5	0 39 38.4	5.336 787	17	257 30 48.7	0 30 45.6	5.307 605
16	250 22 21.7	0 39 27.3	5.336 177	19	257 40 23.2	0 30 33.6	5.306 947
18	250 31 50.0	+0 39 16.1	5.335 566	21	257 49 57.8	+0 30 21.5	5.306 288
20	250 41 18.4	0 39 04.9	5.334 953	23	257 59 32.5	0 30 09.5	5.305 628
22	250 50 47.0	0 38 53.7	5.334 339	25	258 09 07.3	0 29 57.4	5.304 968
24	251 00 15.7	0 38 42.5	5.333 725	27	258 18 42.3	0 29 45.3	5.304 306
26	251 09 44.6	0 38 31.2	5.333 109	29	258 28 17.5	0 29 33.2	5.303 644
28	251 19 13.6	0 38 20.0	5.332 492	31	258 37 52.8	0 29 21.1	5.302 980
Mar. 2	251 28 42.7	+0 38 08.7	5.331 874	June 2	258 47 28.3	+0 29 09.0	5.302 316
4	251 38 11.9	0 37 57.4	5.331 254	4	258 57 03.8	0 28 56.8	5.301 651
6	251 47 41.3	0 37 46.0	5.330 634	6	259 06 39.5	0 28 44.6	5.300 985
8	251 57 10.8	0 37 34.7	5.330 013	8	259 16 15.4	0 28 32.5	5.300 318
10	252 06 40.4	0 37 23.3	5.329 390	10	259 25 51.4	0 28 20.3	5.299 650
12	252 16 10.2	0 37 12.0	5.328 766	12	259 35 27.6	0 28 08.1	5.298 982
14	252 25 40.1	+0 37 00.5	5.328 142	14	259 45 03.9	+0 27 55.8	5.298 312
16	252 35 10.1	0 36 49.1	5.327 516	16	259 54 40.3	0 27 43.6	5.297 642
18	252 44 40.3	0 36 37.7	5.326 889	18	260 04 16.9	0 27 31.3	5.296 971
20	252 54 10.6	0 36 26.2	5.326 261	20	260 13 53.7	0 27 19.0	5.296 299
22	253 03 41.0	0 36 14.7	5.325 632	22	260 23 30.6	0 27 06.7	5.295 626
24	253 13 11.6	0 36 03.2	5.325 002	24	260 33 07.6	0 26 54.4	5.294 952
26	253 22 42.3	+0 35 51.7	5.324 371	26	260 42 44.8	+0 26 42.1	5.294 278
28	253 32 13.1	0 35 40.2	5.323 739	28	260 52 22.1	0 26 29.7	5.293 602
30	253 41 44.1	0 35 28.6	5.323 105	30	261 01 59.6	0 26 17.4	5.292 926
Apr. 1	253 51 15.2	0 35 17.0	5.322 471	July 2	261 11 37.2	0 26 05.0	5.292 249
3	254 00 46.4	+0 35 05.4	5.321 836	4	261 21 15.0	+0 25 52.6	5.291 571

JUPITER, 2019

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude °	′	″	Heliocentric Latitude °	′	″	Radius Vector	Date		Heliocentric Longitude °	′	″	Heliocentric Latitude °	′	″	Radius Vector
July	2	261	11	37.2	+0	26	05.0	5.292 249	Oct.	2	268	37	10.9	+0	16	20.4	5.260 323
	4	261	21	15.0	0	25	52.6	5.291 571		4	268	46	55.7	0	16	07.5	5.259 614
	6	261	30	52.9	0	25	40.2	5.290 893		6	268	56	40.7	0	15	54.4	5.258 904
	8	261	40	31.0	0	25	27.8	5.290 213		8	269	06	25.8	0	15	41.4	5.258 194
	10	261	50	09.2	0	25	15.4	5.289 533		10	269	16	11.1	0	15	28.4	5.257 483
	12	261	59	47.5	0	25	02.9	5.288 852		12	269	25	56.5	0	15	15.3	5.256 772
	14	262	09	26.1	+0	24	50.4	5.288 171		14	269	35	42.1	+0	15	02.3	5.256 060
	16	262	19	04.7	0	24	38.0	5.287 488		16	269	45	27.8	0	14	49.2	5.255 348
	18	262	28	43.5	0	24	25.5	5.286 805		18	269	55	13.8	0	14	36.1	5.254 635
	20	262	38	22.5	0	24	13.0	5.286 121		20	270	04	59.8	0	14	23.0	5.253 921
	22	262	48	01.6	0	24	00.4	5.285 436		22	270	14	46.0	0	14	09.9	5.253 207
	24	262	57	40.8	0	23	47.9	5.284 751		24	270	24	32.4	0	13	56.8	5.252 493
	26	263	07	20.2	+0	23	35.3	5.284 064		26	270	34	19.0	+0	13	43.6	5.251 778
	28	263	16	59.8	0	23	22.8	5.283 377		28	270	44	05.6	0	13	30.5	5.251 062
	30	263	26	39.5	0	23	10.2	5.282 689		30	270	53	52.5	0	13	17.3	5.250 346
Aug.	1	263	36	19.4	0	22	57.6	5.282 001	Nov.	1	271	03	39.5	0	13	04.2	5.249 630
	3	263	45	59.4	0	22	45.0	5.281 312		3	271	13	26.7	0	12	51.0	5.248 913
	5	263	55	39.5	0	22	32.4	5.280 622		5	271	23	14.0	0	12	37.9	5.248 196
	7	264	05	19.8	+0	22	19.7	5.279 931		7	271	33	01.6	+0	12	24.7	5.247 478
	9	264	15	00.3	0	22	07.0	5.279 240		9	271	42	49.2	0	12	11.5	5.246 759
	11	264	24	40.9	0	21	54.4	5.278 548		11	271	52	37.0	0	11	58.3	5.246 041
	13	264	34	21.7	0	21	41.7	5.277 855		13	272	02	25.0	0	11	45.0	5.245 321
	15	264	44	02.6	0	21	29.0	5.277 161		15	272	12	13.2	0	11	31.8	5.244 602
	17	264	53	43.7	0	21	16.3	5.276 467		17	272	22	01.5	0	11	18.6	5.243 882
	19	265	03	24.9	+0	21	03.6	5.275 772		19	272	31	49.9	+0	11	05.3	5.243 161
	21	265	13	06.3	0	20	50.8	5.275 077		21	272	41	38.6	0	10	52.1	5.242 440
	23	265	22	47.8	0	20	38.1	5.274 381		23	272	51	27.3	0	10	38.8	5.241 719
	25	265	32	29.5	0	20	25.3	5.273 684		25	273	01	16.3	0	10	25.6	5.240 997
	27	265	42	11.3	0	20	12.5	5.272 986		27	273	11	05.4	0	10	12.3	5.240 275
	29	265	51	53.3	0	19	59.8	5.272 288		29	273	20	54.7	0	09	59.0	5.239 552
	31	266	01	35.5	+0	19	47.0	5.271 589	Dec.	1	273	30	44.1	+0	09	45.7	5.238 829
Sept.	2	266	11	17.8	0	19	34.2	5.270 890		3	273	40	33.7	0	09	32.4	5.238 106
	4	266	21	00.2	0	19	21.3	5.270 190		5	273	50	23.5	0	09	19.1	5.237 382
	6	266	30	42.8	0	19	08.5	5.269 489		7	274	00	13.4	0	09	05.8	5.236 658
	8	266	40	25.6	0	18	55.6	5.268 787		9	274	10	03.5	0	08	52.4	5.235 934
	10	266	50	08.5	0	18	42.8	5.268 085		11	274	19	53.8	0	08	39.1	5.235 209
	12	266	59	51.6	+0	18	29.9	5.267 383		13	274	29	44.2	+0	08	25.8	5.234 484
	14	267	09	34.8	0	18	17.0	5.266 679		15	274	39	34.8	0	08	12.4	5.233 758
	16	267	19	18.2	0	18	04.1	5.265 976		17	274	49	25.5	0	07	59.1	5.233 032
	18	267	29	01.8	0	17	51.2	5.265 271		19	274	59	16.4	0	07	45.7	5.232 306
	20	267	38	45.5	0	17	38.3	5.264 566		21	275	09	07.5	0	07	32.3	5.231 580
	22	267	48	29.3	0	17	25.3	5.263 860		23	275	18	58.7	0	07	18.9	5.230 853
	24	267	58	13.3	+0	17	12.4	5.263 154		25	275	28	50.1	+0	07	05.5	5.230 125
	26	268	07	57.5	0	16	59.4	5.262 447		27	275	38	41.7	0	06	52.1	5.229 398
	28	268	17	41.8	0	16	46.4	5.261 740		29	275	48	33.4	0	06	38.7	5.228 670
	30	268	27	26.3	0	16	33.4	5.261 032		31	275	58	25.3	0	06	25.3	5.227 942
Oct.	2	268	37	10.9	+0	16	20.4	5.260 323		33	276	08	17.4	+0	06	11.9	5.227 213

JUPITER, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Jan.	0	251	33	31.3	+0	37	43.7	Feb.	15	260	01	03.6	+0	37	16.6
	1	251	46	09.0	0	37	41.9		16	260	09	50.6	0	37	17.1
	2	251	58	43.8	0	37	40.1		17	260	18	30.3	0	37	17.7
	3	252	11	15.7	0	37	38.3		18	260	27	02.6	0	37	18.3
	4	252	23	44.6	0	37	36.7		19	260	35	27.3	0	37	18.9
	5	252	36	10.4	0	37	35.1		20	260	43	44.4	0	37	19.6
	6	252	48	32.9	+0	37	33.5		21	260	51	53.7	+0	37	20.3
	7	253	00	52.0	0	37	32.0		22	260	59	55.2	0	37	21.0
	8	253	13	07.7	0	37	30.6		23	261	07	48.8	0	37	21.8
	9	253	25	19.8	0	37	29.2		24	261	15	34.5	0	37	22.6
	10	253	37	28.2	0	37	27.9		25	261	23	12.1	0	37	23.3
	11	253	49	32.8	0	37	26.7		26	261	30	41.4	0	37	24.2
	12	254	01	33.6	+0	37	25.5		27	261	38	02.5	+0	37	25.0
	13	254	13	30.5	0	37	24.4		28	261	45	15.2	0	37	25.9
	14	254	25	23.3	0	37	23.3	Mar.	1	261	52	19.3	0	37	26.7
	15	254	37	12.0	0	37	22.3		2	261	59	14.7	0	37	27.6
	16	254	48	56.6	0	37	21.4		3	262	06	01.3	0	37	28.5
	17	255	00	37.0	0	37	20.5		4	262	12	39.0	0	37	29.5
	18	255	12	13.0	+0	37	19.7		5	262	19	07.6	+0	37	30.4
	19	255	23	44.6	0	37	18.9		6	262	25	27.1	0	37	31.4
	20	255	35	11.7	0	37	18.2		7	262	31	37.4	0	37	32.4
	21	255	46	34.2	0	37	17.5		8	262	37	38.4	0	37	33.4
	22	255	57	52.0	0	37	16.9		9	262	43	30.0	0	37	34.4
	23	256	09	04.9	0	37	16.4		10	262	49	12.1	0	37	35.5
	24	256	20	12.9	+0	37	15.9		11	262	54	44.7	+0	37	36.5
	25	256	31	15.9	0	37	15.5		12	263	00	07.7	0	37	37.6
	26	256	42	13.8	0	37	15.1		13	263	05	20.9	0	37	38.7
	27	256	53	06.5	0	37	14.7		14	263	10	24.5	0	37	39.8
	28	257	03	54.0	0	37	14.4		15	263	15	18.1	0	37	40.8
	29	257	14	36.1	0	37	14.1		16	263	20	01.9	0	37	41.9
	30	257	25	12.8	+0	37	13.9		17	263	24	35.6	+0	37	43.0
	31	257	35	44.0	0	37	13.7		18	263	28	59.2	0	37	44.1
Feb.	1	257	46	09.4	0	37	13.6		19	263	33	12.5	0	37	45.2
	2	257	56	29.0	0	37	13.5		20	263	37	15.6	0	37	46.3
	3	258	06	42.6	0	37	13.5		21	263	41	08.4	0	37	47.3
	4	258	16	50.2	0	37	13.5		22	263	44	50.8	0	37	48.4
	5	258	26	51.6	+0	37	13.5		23	263	48	22.8	+0	37	49.4
	6	258	36	46.7	0	37	13.6		24	263	51	44.4	0	37	50.4
	7	258	46	35.4	0	37	13.8		25	263	54	55.4	0	37	51.3
	8	258	56	17.6	0	37	14.0		26	263	57	55.7	0	37	52.3
	9	259	05	53.2	0	37	14.2		27	264	00	45.4	0	37	53.2
	10	259	15	22.1	0	37	14.5		28	264	03	24.2	0	37	54.1
	11	259	24	44.3	+0	37	14.8		29	264	05	52.1	+0	37	55.0
	12	259	33	59.6	0	37	15.2		30	264	08	09.1	0	37	55.8
	13	259	43	07.9	0	37	15.6		31	264	10	15.0	0	37	56.7
	14	259	52	09.3	0	37	16.1	Apr.	1	264	12	09.8	0	37	57.4
	15	260	01	03.6	+0	37	16.6		2	264	13	53.5	+0	37	58.2

JUPITER, 2019
GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	264	12	09.8	+0	37	57.4	May	17	262	23	53.5	+0	37	14.6
	2	264	13	53.5	0	37	58.2		18	262	17	46.5	0	37	10.9
	3	264	15	26.0	0	37	58.9		19	262	11	32.6	0	37	07.1
	4	264	16	47.2	0	37	59.6		20	262	05	12.0	0	37	03.1
	5	264	17	57.2	0	38	00.3		21	261	58	44.9	0	36	59.0
	6	264	18	55.9	0	38	00.9		22	261	52	11.4	0	36	54.7
	7	264	19	43.3	+0	38	01.4		23	261	45	31.8	+0	36	50.2
	8	264	20	19.5	0	38	02.0		24	261	38	46.4	0	36	45.6
	9	264	20	44.4	0	38	02.4		25	261	31	55.4	0	36	40.8
	10	264	20	58.0	0	38	02.9		26	261	24	59.1	0	36	35.9
	11	264	21	00.4	0	38	03.2		27	261	17	57.7	0	36	30.8
	12	264	20	51.5	0	38	03.5		28	261	10	51.6	0	36	25.6
	13	264	20	31.3	+0	38	03.8		29	261	03	41.0	+0	36	20.2
	14	264	19	59.8	0	38	04.0		30	260	56	26.2	0	36	14.6
	15	264	19	17.1	0	38	04.1		31	260	49	07.6	0	36	08.9
	16	264	18	23.1	0	38	04.1	June	1	260	41	45.5	0	36	03.1
	17	264	17	17.9	0	38	04.1		2	260	34	20.2	0	35	57.1
	18	264	16	01.6	0	38	04.0		3	260	26	52.1	0	35	50.9
	19	264	14	34.2	+0	38	03.8		4	260	19	21.4	+0	35	44.6
	20	264	12	55.8	0	38	03.5		5	260	11	48.5	0	35	38.1
	21	264	11	06.4	0	38	03.1		6	260	04	13.8	0	35	31.5
	22	264	09	06.1	0	38	02.6		7	259	56	37.4	0	35	24.7
	23	264	06	54.9	0	38	02.0		8	259	48	59.8	0	35	17.7
	24	264	04	32.7	0	38	01.3		9	259	41	21.3	0	35	10.6
	25	264	01	59.8	+0	38	00.6		10	259	33	42.2	+0	35	03.3
	26	263	59	16.1	0	37	59.7		11	259	26	02.8	0	34	55.9
	27	263	56	21.6	0	37	58.7		12	259	18	23.4	0	34	48.3
	28	263	53	16.4	0	37	57.7		13	259	10	44.6	0	34	40.6
	29	263	50	00.7	0	37	56.5		14	259	03	06.4	0	34	32.7
	30	263	46	34.6	0	37	55.2		15	258	55	29.4	0	34	24.6
May	1	263	42	58.0	+0	37	53.8		16	258	47	53.8	+0	34	16.4
	2	263	39	11.2	0	37	52.3		17	258	40	19.8	0	34	08.1
	3	263	35	14.4	0	37	50.7		18	258	32	47.7	0	33	59.6
	4	263	31	07.6	0	37	49.0		19	258	25	17.9	0	33	51.0
	5	263	26	51.0	0	37	47.1		20	258	17	50.7	0	33	42.2
	6	263	22	24.8	0	37	45.2		21	258	10	26.2	0	33	33.3
	7	263	17	49.2	+0	37	43.1		22	258	03	04.8	+0	33	24.3
	8	263	13	04.3	0	37	40.9		23	257	55	46.7	0	33	15.2
	9	263	08	10.3	0	37	38.5		24	257	48	32.4	0	33	05.9
	10	263	03	07.4	0	37	36.0		25	257	41	22.1	0	32	56.5
	11	262	57	55.8	0	37	33.4		26	257	34	16.1	0	32	47.0
	12	262	52	35.5	0	37	30.7		27	257	27	14.6	0	32	37.5
	13	262	47	06.9	+0	37	27.8		28	257	20	18.1	+0	32	27.8
	14	262	41	30.2	0	37	24.7		29	257	13	26.8	0	32	18.0
	15	262	35	45.5	0	37	21.5		30	257	06	41.0	0	32	08.1
	16	262	29	53.2	0	37	18.1	July	1	257	00	01.0	0	31	58.1
	17	262	23	53.5	+0	37	14.6		2	256	53	27.1	+0	31	48.0

JUPITER, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	257	00	01.0	+0	31	58.1	Aug.	16	254	32	06.9	+0	23	24.9
	2	256	53	27.1	0	31	48.0		17	254	33	01.4	0	23	13.7
	3	256	46	59.5	0	31	37.8		18	254	34	06.9	0	23	02.5
	4	256	40	38.5	0	31	27.5		19	254	35	23.4	0	22	51.4
	5	256	34	24.3	0	31	17.1		20	254	36	50.9	0	22	40.4
	6	256	28	17.1	0	31	06.7		21	254	38	29.3	0	22	29.4
	7	256	22	17.2	+0	30	56.1		22	254	40	18.7	+0	22	18.4
	8	256	16	24.9	0	30	45.5		23	254	42	18.9	0	22	07.5
	9	256	10	40.3	0	30	34.8		24	254	44	30.1	0	21	56.6
	10	256	05	03.7	0	30	24.0		25	254	46	52.1	0	21	45.8
	11	255	59	35.3	0	30	13.1		26	254	49	24.9	0	21	35.1
	12	255	54	15.3	0	30	02.2		27	254	52	08.5	0	21	24.3
	13	255	49	03.9	+0	29	51.2		28	254	55	02.7	+0	21	13.7
	14	255	44	01.3	0	29	40.2		29	254	58	07.6	0	21	03.0
	15	255	39	07.5	0	29	29.0		30	255	01	23.0	0	20	52.5
	16	255	34	22.8	0	29	17.9		31	255	04	49.0	0	20	41.9
	17	255	29	47.2	0	29	06.7	Sept.	1	255	08	25.4	0	20	31.5
	18	255	25	21.0	0	28	55.4		2	255	12	12.1	0	20	21.0
	19	255	21	04.1	+0	28	44.1		3	255	16	09.3	+0	20	10.7
	20	255	16	56.8	0	28	32.8		4	255	20	16.8	0	20	00.3
	21	255	12	59.2	0	28	21.5		5	255	24	34.4	0	19	50.0
	22	255	09	11.4	0	28	10.1		6	255	29	02.2	0	19	39.8
	23	255	05	33.6	0	27	58.7		7	255	33	40.1	0	19	29.6
	24	255	02	05.9	0	27	47.3		8	255	38	27.8	0	19	19.5
	25	254	58	48.4	+0	27	35.8		9	255	43	25.3	+0	19	09.4
	26	254	55	41.3	0	27	24.4		10	255	48	32.5	0	18	59.4
	27	254	52	44.6	0	27	13.0		11	255	53	49.3	0	18	49.4
	28	254	49	58.5	0	27	01.5		12	255	59	15.6	0	18	39.5
	29	254	47	23.1	0	26	50.0		13	256	04	51.3	0	18	29.7
	30	254	44	58.4	0	26	38.6		14	256	10	36.4	0	18	19.9
	31	254	42	44.6	+0	26	27.1		15	256	16	30.6	+0	18	10.2
Aug.	1	254	40	41.6	0	26	15.7		16	256	22	34.1	0	18	00.6
	2	254	38	49.5	0	26	04.2		17	256	28	46.7	0	17	51.0
	3	254	37	08.3	0	25	52.7		18	256	35	08.3	0	17	41.5
	4	254	35	38.2	0	25	41.3		19	256	41	38.9	0	17	32.0
	5	254	34	19.2	0	25	29.8		20	256	48	18.4	0	17	22.6
	6	254	33	11.3	+0	25	18.4		21	256	55	06.7	+0	17	13.3
	7	254	32	14.6	0	25	06.9		22	257	02	03.8	0	17	04.0
	8	254	31	29.1	0	24	55.5		23	257	09	09.5	0	16	54.8
	9	254	30	54.9	0	24	44.1		24	257	16	23.7	0	16	45.7
	10	254	30	31.8	0	24	32.7		25	257	23	46.4	0	16	36.6
	11	254	30	19.9	0	24	21.3		26	257	31	17.4	0	16	27.5
	12	254	30	19.1	+0	24	10.0		27	257	38	56.6	+0	16	18.6
	13	254	30	29.5	0	23	58.6		28	257	46	44.0	0	16	09.6
	14	254	30	50.9	0	23	47.3		29	257	54	39.5	0	16	00.7
	15	254	31	23.4	0	23	36.1		30	258	02	43.0	0	15	51.9
	16	254	32	06.9	+0	23	24.9	Oct.	1	258	10	54.5	+0	15	43.1

JUPITER, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	258	10	54.5	+0	15	43.1	Nov.	16	266	22	07.2	+0	09	54.6
	2	258	19	13.8	0	15	34.4		17	266	34	42.7	0	09	48.1
	3	258	27	40.9	0	15	25.7		18	266	47	21.7	0	09	41.6
	4	258	36	15.5	0	15	17.1		19	267	00	04.0	0	09	35.1
	5	258	44	57.7	0	15	08.6		20	267	12	49.6	0	09	28.6
	6	258	53	47.3	0	15	00.1		21	267	25	38.5	0	09	22.2
	7	259	02	44.0	+0	14	51.6		22	267	38	30.5	+0	09	15.8
	8	259	11	47.9	0	14	43.2		23	267	51	25.6	0	09	09.4
	9	259	20	58.9	0	14	34.9		24	268	04	23.7	0	09	03.1
	10	259	30	16.7	0	14	26.6		25	268	17	24.8	0	08	56.8
	11	259	39	41.4	0	14	18.4		26	268	30	28.8	0	08	50.5
	12	259	49	12.8	0	14	10.2		27	268	43	35.6	0	08	44.2
	13	259	58	50.9	+0	14	02.1		28	268	56	45.0	+0	08	38.0
	14	260	08	35.5	0	13	54.0		29	269	09	57.1	0	08	31.7
	15	260	18	26.7	0	13	46.0		30	269	23	11.5	0	08	25.5
	16	260	28	24.3	0	13	38.1	Dec.	1	269	36	28.4	0	08	19.4
	17	260	38	28.3	0	13	30.2		2	269	49	47.4	0	08	13.2
	18	260	48	38.5	0	13	22.4		3	270	03	08.6	0	08	07.1
	19	260	58	54.9	+0	13	14.6		4	270	16	31.8	+0	08	01.1
	20	261	09	17.4	0	13	06.9		5	270	29	57.0	0	07	55.0
	21	261	19	45.9	0	12	59.2		6	270	43	24.1	0	07	49.0
	22	261	30	20.3	0	12	51.6		7	270	56	53.0	0	07	43.0
	23	261	41	00.4	0	12	44.0		8	271	10	23.7	0	07	37.0
	24	261	51	46.3	0	12	36.4		9	271	23	56.1	0	07	31.1
	25	262	02	37.8	+0	12	28.9		10	271	37	30.1	+0	07	25.2
	26	262	13	34.8	0	12	21.5		11	271	51	05.7	0	07	19.3
	27	262	24	37.2	0	12	14.1		12	272	04	42.8	0	07	13.4
	28	262	35	45.1	0	12	06.7		13	272	18	21.3	0	07	07.6
	29	262	46	58.4	0	11	59.4		14	272	32	01.1	0	07	01.7
	30	262	58	16.8	0	11	52.1		15	272	45	42.1	0	06	55.9
	31	263	09	40.4	+0	11	44.8		16	272	59	24.3	+0	06	50.1
Nov.	1	263	21	09.0	0	11	37.6		17	273	13	07.6	0	06	44.3
	2	263	32	42.4	0	11	30.4		18	273	26	51.8	0	06	38.6
	3	263	44	20.6	0	11	23.3		19	273	40	36.9	0	06	32.8
	4	263	56	03.4	0	11	16.2		20	273	54	22.9	0	06	27.1
	5	264	07	50.8	0	11	09.2		21	274	08	09.7	0	06	21.3
	6	264	19	42.6	+0	11	02.2		22	274	21	57.2	+0	06	15.6
	7	264	31	38.7	0	10	55.3		23	274	35	45.4	0	06	09.9
	8	264	43	39.1	0	10	48.4		24	274	49	34.3	0	06	04.2
	9	264	55	43.7	0	10	41.5		25	275	03	23.6	0	05	58.5
	10	265	07	52.4	0	10	34.7		26	275	17	13.3	0	05	52.8
	11	265	20	05.2	0	10	27.9		27	275	31	03.6	0	05	47.2
	12	265	32	21.9	+0	10	21.2		28	275	44	51.3	+0	05	42.3
	13	265	44	42.6	0	10	14.5		29	275	58	42.7	0	05	35.8
	14	265	57	07.1	0	10	07.8		30	276	12	33.0	0	05	30.2
	15	266	09	35.3	0	10	01.2		31	276	26	22.9	0	05	24.5
	16	266	22	07.2	+0	09	54.6		32	276	40	12.6	+0	05	18.9

JUPITER, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	16	40	28.52	-21	32	35.2	6.201 438	1.42	14.84	10	01	43
	1	16	41	22.31	21	34	18.9	6.193 538	1.42	14.86	9	58	41
	2	16	42	15.93	21	36	01.1	6.185 439	1.42	14.88	9	55	38
	3	16	43	09.36	21	37	41.7	6.177 144	1.42	14.90	9	52	35
	4	16	44	02.60	21	39	20.9	6.168 655	1.43	14.92	9	49	32
	5	16	44	55.63	21	40	58.4	6.159 972	1.43	14.94	9	46	29
	6	16	45	48.46	-21	42	34.5	6.151 097	1.43	14.97	9	43	26
	7	16	46	41.06	21	44	08.9	6.142 031	1.43	14.99	9	40	22
	8	16	47	33.44	21	45	41.9	6.132 777	1.43	15.01	9	37	18
	9	16	48	25.58	21	47	13.3	6.123 337	1.44	15.03	9	34	14
	10	16	49	17.48	21	48	43.1	6.113 711	1.44	15.06	9	31	10
	11	16	50	09.13	21	50	11.4	6.103 903	1.44	15.08	9	28	05
	12	16	51	00.52	-21	51	38.1	6.093 913	1.44	15.11	9	25	00
	13	16	51	51.65	21	53	03.3	6.083 745	1.45	15.13	9	21	55
	14	16	52	42.51	21	54	26.9	6.073 400	1.45	15.16	9	18	50
	15	16	53	33.09	21	55	49.0	6.062 880	1.45	15.18	9	15	44
	16	16	54	23.40	21	57	09.5	6.052 187	1.45	15.21	9	12	38
	17	16	55	13.42	21	58	28.5	6.041 324	1.46	15.24	9	09	32
	18	16	56	03.14	-21	59	46.1	6.030 293	1.46	15.27	9	06	25
	19	16	56	52.57	22	01	02.1	6.019 095	1.46	15.29	9	03	18
	20	16	57	41.69	22	02	16.7	6.007 733	1.46	15.32	9	00	11
	21	16	58	30.49	22	03	29.8	5.996 209	1.47	15.35	8	57	04
	22	16	59	18.97	22	04	41.5	5.984 525	1.47	15.38	8	53	56
	23	17	00	07.12	22	05	51.7	5.972 682	1.47	15.41	8	50	48
	24	17	00	54.93	-22	07	00.4	5.960 682	1.48	15.44	8	47	39
	25	17	01	42.39	22	08	07.7	5.948 527	1.48	15.48	8	44	30
	26	17	02	29.50	22	09	13.5	5.936 218	1.48	15.51	8	41	21
	27	17	03	16.26	22	10	17.9	5.923 759	1.48	15.54	8	38	12
	28	17	04	02.65	22	11	20.9	5.911 150	1.49	15.57	8	35	02
	29	17	04	48.67	22	12	22.5	5.898 393	1.49	15.61	8	31	52
	30	17	05	34.32	-22	13	22.7	5.885 492	1.49	15.64	8	28	41
	31	17	06	19.57	22	14	21.5	5.872 448	1.50	15.68	8	25	30
Feb.	1	17	07	04.42	22	15	18.9	5.859 265	1.50	15.71	8	22	19
	2	17	07	48.87	22	16	15.1	5.845 944	1.50	15.75	8	19	07
	3	17	08	32.90	22	17	09.9	5.832 488	1.51	15.78	8	15	55
	4	17	09	16.51	22	18	03.3	5.818 900	1.51	15.82	8	12	42
	5	17	09	59.68	-22	18	55.5	5.805 183	1.51	15.86	8	09	29
	6	17	10	42.41	22	19	46.3	5.791 340	1.52	15.90	8	06	15
	7	17	11	24.68	22	20	35.8	5.777 374	1.52	15.93	8	03	01
	8	17	12	06.50	22	21	24.1	5.763 288	1.53	15.97	7	59	47
	9	17	12	47.85	22	22	11.0	5.749 084	1.53	16.01	7	56	32
	10	17	13	28.74	22	22	56.7	5.734 767	1.53	16.05	7	53	16
	11	17	14	09.14	-22	23	41.1	5.720 340	1.54	16.09	7	50	01
	12	17	14	49.06	22	24	24.3	5.705 804	1.54	16.13	7	46	44
	13	17	15	28.48	22	25	06.3	5.691 165	1.55	16.18	7	43	27
	14	17	16	07.41	22	25	47.1	5.676 425	1.55	16.22	7	40	10
	15	17	16	45.84	-22	26	26.8	5.661 587	1.55	16.26	7	36	52

JUPITER, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	17	16	45.84	-22	26	26.8	5.661 587	1.55	16.26	7	36	52
	16	17	17	23.75	22	27	05.3	5.646 654	1.56	16.30	7	33	34
	17	17	18	01.14	22	27	42.6	5.631 630	1.56	16.35	7	30	15
	18	17	18	38.01	22	28	18.9	5.616 518	1.57	16.39	7	26	56
	19	17	19	14.33	22	28	54.2	5.601 320	1.57	16.44	7	23	36
	20	17	19	50.11	22	29	28.3	5.586 040	1.57	16.48	7	20	15
	21	17	20	25.33	-22	30	01.3	5.570 679	1.58	16.53	7	16	54
	22	17	21	00.00	22	30	33.3	5.555 242	1.58	16.57	7	13	33
	23	17	21	34.10	22	31	04.2	5.539 730	1.59	16.62	7	10	10
	24	17	22	07.64	22	31	34.2	5.524 147	1.59	16.67	7	06	48
	25	17	22	40.60	22	32	03.1	5.508 497	1.60	16.71	7	03	24
	26	17	23	12.97	22	32	31.0	5.492 781	1.60	16.76	7	00	01
	27	17	23	44.75	-22	32	58.0	5.477 004	1.61	16.81	6	56	36
	28	17	24	15.92	22	33	24.1	5.461 169	1.61	16.86	6	53	11
Mar.	1	17	24	46.48	22	33	49.2	5.445 280	1.62	16.91	6	49	45
	2	17	25	16.42	22	34	13.4	5.429 340	1.62	16.96	6	46	19
	3	17	25	45.72	22	34	36.8	5.413 353	1.62	17.01	6	42	52
	4	17	26	14.39	22	34	59.3	5.397 323	1.63	17.06	6	39	25
	5	17	26	42.40	-22	35	20.9	5.381 254	1.63	17.11	6	35	56
	6	17	27	09.77	22	35	41.7	5.365 150	1.64	17.16	6	32	27
	7	17	27	36.47	22	36	01.6	5.349 014	1.64	17.21	6	28	58
	8	17	28	02.50	22	36	20.8	5.332 852	1.65	17.26	6	25	28
	9	17	28	27.85	22	36	39.0	5.316 666	1.65	17.32	6	21	57
	10	17	28	52.52	22	36	56.5	5.300 462	1.66	17.37	6	18	25
	11	17	29	16.51	-22	37	13.3	5.284 243	1.66	17.42	6	14	53
	12	17	29	39.81	22	37	29.2	5.268 014	1.67	17.48	6	11	20
	13	17	30	02.41	22	37	44.5	5.251 778	1.67	17.53	6	07	47
	14	17	30	24.30	22	37	59.0	5.235 541	1.68	17.58	6	04	12
	15	17	30	45.49	22	38	12.9	5.219 305	1.68	17.64	6	00	37
	16	17	31	05.96	22	38	26.1	5.203 076	1.69	17.69	5	57	02
	17	17	31	25.71	-22	38	38.6	5.186 857	1.70	17.75	5	53	25
	18	17	31	44.73	22	38	50.6	5.170 652	1.70	17.80	5	49	48
	19	17	32	03.01	22	39	01.9	5.154 465	1.71	17.86	5	46	10
	20	17	32	20.56	22	39	12.6	5.138 299	1.71	17.92	5	42	31
	21	17	32	37.36	22	39	22.6	5.122 159	1.72	17.97	5	38	52
	22	17	32	53.41	22	39	32.1	5.106 048	1.72	18.03	5	35	12
	23	17	33	08.71	-22	39	41.0	5.089 970	1.73	18.09	5	31	31
	24	17	33	23.26	22	39	49.3	5.073 928	1.73	18.14	5	27	50
	25	17	33	37.04	22	39	57.0	5.057 927	1.74	18.20	5	24	07
	26	17	33	50.06	22	40	04.2	5.041 971	1.74	18.26	5	20	24
	27	17	34	02.31	22	40	10.9	5.026 063	1.75	18.32	5	16	40
	28	17	34	13.78	22	40	17.1	5.010 209	1.76	18.37	5	12	55
	29	17	34	24.46	-22	40	22.9	4.994 413	1.76	18.43	5	09	10
	30	17	34	34.35	22	40	28.1	4.978 678	1.77	18.49	5	05	24
	31	17	34	43.44	22	40	32.8	4.963 010	1.77	18.55	5	01	37
Apr.	1	17	34	51.73	22	40	37.1	4.947 414	1.78	18.61	4	57	49
	2	17	34	59.21	-22	40	40.9	4.931 893	1.78	18.67	4	54	00

JUPITER, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	17	34	51.73	-22	40	37.1	4.947 414	1.78	18.61	4	57	49
	2	17	34	59.21	22	40	40.9	4.931 893	1.78	18.67	4	54	00
	3	17	35	05.89	22	40	44.2	4.916 453	1.79	18.72	4	50	11
	4	17	35	11.75	22	40	47.0	4.901 099	1.79	18.78	4	46	21
	5	17	35	16.80	22	40	49.3	4.885 834	1.80	18.84	4	42	30
	6	17	35	21.04	22	40	51.2	4.870 664	1.81	18.90	4	38	38
	7	17	35	24.47	-22	40	52.6	4.855 594	1.81	18.96	4	34	45
	8	17	35	27.08	22	40	53.6	4.840 628	1.82	19.02	4	30	52
	9	17	35	28.88	22	40	54.1	4.825 771	1.82	19.08	4	26	57
	10	17	35	29.87	22	40	54.3	4.811 028	1.83	19.14	4	23	02
	11	17	35	30.04	22	40	54.0	4.796 403	1.83	19.19	4	19	06
	12	17	35	29.40	22	40	53.3	4.781 901	1.84	19.25	4	15	10
	13	17	35	27.94	-22	40	52.2	4.767 526	1.84	19.31	4	11	12
	14	17	35	25.67	22	40	50.7	4.753 282	1.85	19.37	4	07	14
	15	17	35	22.58	22	40	48.8	4.739 175	1.86	19.43	4	03	15
	16	17	35	18.69	22	40	46.5	4.725 207	1.86	19.48	3	59	15
	17	17	35	13.98	22	40	43.8	4.711 383	1.87	19.54	3	55	14
	18	17	35	08.48	22	40	40.6	4.697 706	1.87	19.60	3	51	13
	19	17	35	02.17	-22	40	37.0	4.684 182	1.88	19.65	3	47	10
	20	17	34	55.06	22	40	33.0	4.670 813	1.88	19.71	3	43	07
	21	17	34	47.17	22	40	28.6	4.657 603	1.89	19.77	3	39	03
	22	17	34	38.48	22	40	23.7	4.644 558	1.89	19.82	3	34	59
	23	17	34	29.01	22	40	18.5	4.631 680	1.90	19.88	3	30	53
	24	17	34	18.75	22	40	12.8	4.618 975	1.90	19.93	3	26	47
	25	17	34	07.71	-22	40	06.8	4.606 446	1.91	19.99	3	22	40
	26	17	33	55.89	22	40	00.3	4.594 097	1.91	20.04	3	18	32
	27	17	33	43.29	22	39	53.3	4.581 934	1.92	20.09	3	14	24
	28	17	33	29.93	22	39	46.0	4.569 960	1.92	20.14	3	10	14
	29	17	33	15.80	22	39	38.2	4.558 181	1.93	20.20	3	06	04
	30	17	33	00.92	22	39	29.9	4.546 599	1.93	20.25	3	01	54
May	1	17	32	45.29	-22	39	21.1	4.535 220	1.94	20.30	2	57	42
	2	17	32	28.92	22	39	11.8	4.524 048	1.94	20.35	2	53	30
	3	17	32	11.82	22	39	02.1	4.513 087	1.95	20.40	2	49	17
	4	17	31	54.01	22	38	51.8	4.502 341	1.95	20.45	2	45	03
	5	17	31	35.50	22	38	41.1	4.491 815	1.96	20.50	2	40	49
	6	17	31	16.29	22	38	29.8	4.481 512	1.96	20.54	2	36	34
	7	17	30	56.40	-22	38	18.1	4.471 436	1.97	20.59	2	32	18
	8	17	30	35.84	22	38	05.8	4.461 592	1.97	20.63	2	28	01
	9	17	30	14.63	22	37	53.1	4.451 983	1.98	20.68	2	23	44
	10	17	29	52.77	22	37	39.9	4.442 612	1.98	20.72	2	19	27
	11	17	29	30.28	22	37	26.2	4.433 483	1.98	20.76	2	15	08
	12	17	29	07.18	22	37	12.0	4.424 599	1.99	20.81	2	10	49
	13	17	28	43.47	-22	36	57.2	4.415 963	1.99	20.85	2	06	30
	14	17	28	19.17	22	36	42.0	4.407 577	2.00	20.89	2	02	10
	15	17	27	54.31	22	36	26.2	4.399 444	2.00	20.93	1	57	49
	16	17	27	28.90	22	36	09.8	4.391 568	2.00	20.96	1	53	28
	17	17	27	02.95	-22	35	52.9	4.383 949	2.01	21.00	1	49	06

JUPITER, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	17	27	02.95	-22	35	52.9	4.383 949	2.01	21.00	1	49	06
	18	17	26	36.48	22	35	35.5	4.376 592	2.01	21.03	1	44	44
	19	17	26	09.51	22	35	17.5	4.369 498	2.01	21.07	1	40	21
	20	17	25	42.06	22	34	59.0	4.362 670	2.02	21.10	1	35	58
	21	17	25	14.14	22	34	40.0	4.356 110	2.02	21.13	1	31	34
	22	17	24	45.77	22	34	20.5	4.349 821	2.02	21.16	1	27	10
	23	17	24	16.96	-22	34	00.4	4.343 806	2.02	21.19	1	22	45
	24	17	23	47.73	22	33	39.9	4.338 066	2.03	21.22	1	18	20
	25	17	23	18.10	22	33	18.8	4.332 604	2.03	21.25	1	13	55
	26	17	22	48.09	22	32	57.1	4.327 423	2.03	21.27	1	09	29
	27	17	22	17.71	22	32	35.0	4.322 524	2.03	21.30	1	05	03
	28	17	21	47.00	22	32	12.3	4.317 911	2.04	21.32	1	00	37
	29	17	21	15.96	-22	31	49.0	4.313 584	2.04	21.34	0	56	10
	30	17	20	44.63	22	31	25.3	4.309 545	2.04	21.36	0	51	43
	31	17	20	13.02	22	31	01.0	4.305 797	2.04	21.38	0	47	15
June	1	17	19	41.17	22	30	36.2	4.302 342	2.04	21.40	0	42	48
	2	17	19	09.08	22	30	11.0	4.299 179	2.05	21.41	0	38	20
	3	17	18	36.80	22	29	45.3	4.296 312	2.05	21.43	0	33	52
	4	17	18	04.33	-22	29	19.2	4.293 741	2.05	21.44	0	29	24
	5	17	17	31.71	22	28	52.6	4.291 468	2.05	21.45	0	24	55
	6	17	16	58.96	22	28	25.7	4.289 492	2.05	21.46	0	20	27
	7	17	16	26.09	22	27	58.4	4.287 814	2.05	21.47	0	15	58
	8	17	15	53.14	22	27	30.8	4.286 434	2.05	21.48	0	11	30
	9	17	15	20.12	22	27	02.9	4.285 354	2.05	21.48	0	07	01
	10	17	14	47.06	-22	26	34.6	4.284 571	2.05	21.49	0	02	32
	11	17	14	13.99	22	26	06.0	4.284 086	2.05	21.49	23	53	35
	12	17	13	40.92	22	25	37.1	4.283 899	2.05	21.49	23	49	06
	13	17	13	07.89	22	25	07.9	4.284 009	2.05	21.49	23	44	37
	14	17	12	34.92	22	24	38.6	4.284 414	2.05	21.49	23	40	09
	15	17	12	02.03	22	24	09.0	4.285 116	2.05	21.48	23	35	40
	16	17	11	29.24	-22	23	39.3	4.286 112	2.05	21.48	23	31	12
	17	17	10	56.58	22	23	09.4	4.287 402	2.05	21.47	23	26	43
	18	17	10	24.05	22	22	39.5	4.288 985	2.05	21.46	23	22	15
	19	17	09	51.69	22	22	09.4	4.290 860	2.05	21.45	23	17	47
	20	17	09	19.52	22	21	39.4	4.293 027	2.05	21.44	23	13	20
	21	17	08	47.54	22	21	09.3	4.295 485	2.05	21.43	23	08	52
	22	17	08	15.80	-22	20	39.2	4.298 232	2.05	21.42	23	04	25
	23	17	07	44.29	22	20	09.2	4.301 267	2.04	21.40	22	59	58
	24	17	07	13.06	22	19	39.2	4.304 589	2.04	21.39	22	55	31
	25	17	06	42.12	22	19	09.3	4.308 197	2.04	21.37	22	51	05
	26	17	06	11.48	22	18	39.5	4.312 089	2.04	21.35	22	46	39
	27	17	05	41.18	22	18	09.9	4.316 264	2.04	21.33	22	42	13
	28	17	05	11.24	-22	17	40.5	4.320 720	2.04	21.31	22	37	48
	29	17	04	41.67	22	17	11.3	4.325 456	2.03	21.28	22	33	23
	30	17	04	12.50	22	16	42.4	4.330 468	2.03	21.26	22	28	58
July	1	17	03	43.75	22	16	13.8	4.335 756	2.03	21.23	22	24	34
	2	17	03	15.44	-22	15	45.6	4.341 316	2.03	21.21	22	20	11

JUPITER, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	17	03	43.75	-22	16	13.8	4.335 756	2.03	21.23	22	24	34
	2	17	03	15.44	22	15	45.6	4.341 316	2.03	21.21	22	20	11
	3	17	02	47.59	22	15	17.8	4.347 147	2.02	21.18	22	15	48
	4	17	02	20.20	22	14	50.5	4.353 245	2.02	21.15	22	11	25
	5	17	01	53.31	22	14	23.7	4.359 608	2.02	21.12	22	07	03
	6	17	01	26.92	22	13	57.4	4.366 232	2.01	21.08	22	02	41
	7	17	01	01.06	-22	13	31.6	4.373 115	2.01	21.05	21	58	20
	8	17	00	35.74	22	13	06.4	4.380 252	2.01	21.02	21	53	59
	9	17	00	10.97	22	12	41.9	4.387 641	2.00	20.98	21	49	39
	10	16	59	46.79	22	12	17.9	4.395 277	2.00	20.95	21	45	20
	11	16	59	23.19	22	11	54.7	4.403 157	2.00	20.91	21	41	01
	12	16	59	00.19	22	11	32.2	4.411 278	1.99	20.87	21	36	43
	13	16	58	37.82	-22	11	10.4	4.419 636	1.99	20.83	21	32	25
	14	16	58	16.07	22	10	49.5	4.428 228	1.99	20.79	21	28	08
	15	16	57	54.95	22	10	29.3	4.437 049	1.98	20.75	21	23	52
	16	16	57	34.49	22	10	10.1	4.446 097	1.98	20.71	21	19	36
	17	16	57	14.68	22	09	51.7	4.455 368	1.97	20.66	21	15	21
	18	16	56	55.54	22	09	34.2	4.464 859	1.97	20.62	21	11	07
	19	16	56	37.07	-22	09	17.7	4.474 566	1.97	20.57	21	06	53
	20	16	56	19.28	22	09	02.1	4.484 486	1.96	20.53	21	02	40
	21	16	56	02.19	22	08	47.4	4.494 614	1.96	20.48	20	58	28
	22	16	55	45.81	22	08	33.8	4.504 949	1.95	20.44	20	54	16
	23	16	55	30.14	22	08	21.1	4.515 485	1.95	20.39	20	50	05
	24	16	55	15.19	22	08	09.5	4.526 219	1.94	20.34	20	45	55
	25	16	55	00.97	-22	07	58.9	4.537 148	1.94	20.29	20	41	46
	26	16	54	47.50	22	07	49.4	4.548 268	1.93	20.24	20	37	37
	27	16	54	34.77	22	07	41.0	4.559 575	1.93	20.19	20	33	29
	28	16	54	22.80	22	07	33.7	4.571 064	1.92	20.14	20	29	22
	29	16	54	11.60	22	07	27.6	4.582 733	1.92	20.09	20	25	16
	30	16	54	01.16	22	07	22.7	4.594 576	1.91	20.04	20	21	10
	31	16	53	51.49	-22	07	19.0	4.606 591	1.91	19.98	20	17	05
Aug.	1	16	53	42.61	22	07	16.5	4.618 771	1.90	19.93	20	13	01
	2	16	53	34.50	22	07	15.3	4.631 113	1.90	19.88	20	08	58
	3	16	53	27.17	22	07	15.2	4.643 612	1.89	19.83	20	04	55
	4	16	53	20.64	22	07	16.4	4.656 264	1.89	19.77	20	00	54
	5	16	53	14.89	22	07	18.8	4.669 063	1.88	19.72	19	56	53
	6	16	53	09.94	-22	07	22.4	4.682 005	1.88	19.66	19	52	52
	7	16	53	05.80	22	07	27.3	4.695 085	1.87	19.61	19	48	53
	8	16	53	02.45	22	07	33.4	4.708 298	1.87	19.55	19	44	54
	9	16	52	59.91	22	07	40.8	4.721 641	1.86	19.50	19	40	57
	10	16	52	58.16	22	07	49.5	4.735 109	1.86	19.44	19	36	60
	11	16	52	57.22	22	07	59.4	4.748 697	1.85	19.39	19	33	03
	12	16	52	57.07	-22	08	10.6	4.762 401	1.85	19.33	19	29	08
	13	16	52	57.71	22	08	23.1	4.776 217	1.84	19.27	19	25	13
	14	16	52	59.15	22	08	36.8	4.790 141	1.84	19.22	19	21	20
	15	16	53	01.38	22	08	51.8	4.804 169	1.83	19.16	19	17	27
	16	16	53	04.40	-22	09	08.0	4.818 297	1.83	19.11	19	13	34

JUPITER, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	16	53	04.40	-22	09	08.0	4.818 297	1.83	19.11	19	13	34
	17	16	53	08.21	22	09	25.4	4.832 521	1.82	19.05	19	09	43
	18	16	53	12.80	22	09	44.0	4.846 837	1.81	18.99	19	05	52
	19	16	53	18.18	22	10	03.8	4.861 241	1.81	18.94	19	02	02
	20	16	53	24.34	22	10	24.8	4.875 729	1.80	18.88	18	58	13
	21	16	53	31.29	22	10	46.9	4.890 297	1.80	18.83	18	54	25
	22	16	53	39.02	-22	11	10.2	4.904 941	1.79	18.77	18	50	37
	23	16	53	47.54	22	11	34.7	4.919 658	1.79	18.71	18	46	50
	24	16	53	56.83	22	12	00.3	4.934 442	1.78	18.66	18	43	04
	25	16	54	06.90	22	12	27.1	4.949 291	1.78	18.60	18	39	19
	26	16	54	17.75	22	12	55.0	4.964 200	1.77	18.54	18	35	34
	27	16	54	29.37	22	13	24.0	4.979 165	1.77	18.49	18	31	50
	28	16	54	41.75	-22	13	54.2	4.994 182	1.76	18.43	18	28	07
	29	16	54	54.90	22	14	25.5	5.009 246	1.76	18.38	18	24	25
	30	16	55	08.80	22	14	57.8	5.024 353	1.75	18.32	18	20	44
	31	16	55	23.46	22	15	31.1	5.039 499	1.75	18.27	18	17	03
Sept.	1	16	55	38.87	22	16	05.5	5.054 678	1.74	18.21	18	13	23
	2	16	55	55.02	22	16	40.8	5.069 888	1.73	18.16	18	09	44
	3	16	56	11.93	-22	17	17.1	5.085 122	1.73	18.10	18	06	05
	4	16	56	29.57	22	17	54.4	5.100 377	1.72	18.05	18	02	27
	5	16	56	47.95	22	18	32.5	5.115 649	1.72	18.00	17	58	50
	6	16	57	07.05	22	19	11.6	5.130 934	1.71	17.94	17	55	14
	7	16	57	26.88	22	19	51.6	5.146 227	1.71	17.89	17	51	38
	8	16	57	47.42	22	20	32.4	5.161 526	1.70	17.84	17	48	03
	9	16	58	08.66	-22	21	14.1	5.176 826	1.70	17.78	17	44	29
	10	16	58	30.61	22	21	56.6	5.192 124	1.69	17.73	17	40	55
	11	16	58	53.25	22	22	39.8	5.207 416	1.69	17.68	17	37	23
	12	16	59	16.57	22	23	23.8	5.222 698	1.68	17.63	17	33	50
	13	16	59	40.57	22	24	08.5	5.237 968	1.68	17.58	17	30	19
	14	17	00	05.24	22	24	53.8	5.253 222	1.67	17.52	17	26	48
	15	17	00	30.59	-22	25	39.8	5.268 457	1.67	17.47	17	23	18
	16	17	00	56.60	22	26	26.4	5.283 669	1.66	17.42	17	19	48
	17	17	01	23.26	22	27	13.6	5.298 855	1.66	17.37	17	16	19
	18	17	01	50.59	22	28	01.3	5.314 012	1.65	17.32	17	12	51
	19	17	02	18.56	22	28	49.5	5.329 137	1.65	17.27	17	09	23
	20	17	02	47.17	22	29	38.2	5.344 225	1.65	17.23	17	05	56
	21	17	03	16.43	-22	30	27.4	5.359 275	1.64	17.18	17	02	30
	22	17	03	46.32	22	31	17.1	5.374 282	1.64	17.13	16	59	04
	23	17	04	16.84	22	32	07.2	5.389 243	1.63	17.08	16	55	39
	24	17	04	47.98	22	32	57.7	5.404 155	1.63	17.04	16	52	15
	25	17	05	19.73	22	33	48.6	5.419 015	1.62	16.99	16	48	51
	26	17	05	52.08	22	34	39.9	5.433 818	1.62	16.94	16	45	28
	27	17	06	25.04	-22	35	31.4	5.448 561	1.61	16.90	16	42	05
	28	17	06	58.59	22	36	23.2	5.463 240	1.61	16.85	16	38	43
	29	17	07	32.73	22	37	15.2	5.477 853	1.61	16.81	16	35	21
	30	17	08	07.45	22	38	07.3	5.492 394	1.60	16.76	16	32	00
Oct.	1	17	08	42.75	-22	38	59.7	5.506 861	1.60	16.72	16	28	40

JUPITER, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	17	08	42.75	-22	38	59.7	5.506 861	1.60	16.72	16	28	40
	2	17	09	18.63	22	39	52.1	5.521 250	1.59	16.67	16	25	20
	3	17	09	55.07	22	40	44.7	5.535 559	1.59	16.63	16	22	01
	4	17	10	32.07	22	41	37.4	5.549 782	1.58	16.59	16	18	42
	5	17	11	09.62	22	42	30.1	5.563 919	1.58	16.55	16	15	24
	6	17	11	47.71	22	43	22.8	5.577 965	1.58	16.50	16	12	06
	7	17	12	26.32	-22	44	15.6	5.591 919	1.57	16.46	16	08	49
	8	17	13	05.46	22	45	08.2	5.605 777	1.57	16.42	16	05	32
	9	17	13	45.11	22	46	00.8	5.619 537	1.56	16.38	16	02	16
	10	17	14	25.27	22	46	53.3	5.633 195	1.56	16.34	15	59	01
	11	17	15	05.93	22	47	45.5	5.646 751	1.56	16.30	15	55	46
	12	17	15	47.09	22	48	37.6	5.660 201	1.55	16.26	15	52	31
	13	17	16	28.73	-22	49	29.4	5.673 542	1.55	16.23	15	49	17
	14	17	17	10.86	22	50	21.0	5.686 773	1.55	16.19	15	46	03
	15	17	17	53.47	22	51	12.2	5.699 890	1.54	16.15	15	42	50
	16	17	18	36.55	22	52	03.2	5.712 892	1.54	16.11	15	39	37
	17	17	19	20.10	22	52	53.7	5.725 777	1.54	16.08	15	36	25
	18	17	20	04.12	22	53	44.0	5.738 540	1.53	16.04	15	33	13
	19	17	20	48.59	-22	54	33.8	5.751 182	1.53	16.01	15	30	02
	20	17	21	33.50	22	55	23.2	5.763 698	1.53	15.97	15	26	51
	21	17	22	18.86	22	56	12.2	5.776 086	1.52	15.94	15	23	40
	22	17	23	04.66	22	57	00.7	5.788 344	1.52	15.90	15	20	30
	23	17	23	50.88	22	57	48.8	5.800 469	1.52	15.87	15	17	21
	24	17	24	37.52	22	58	36.3	5.812 459	1.51	15.84	15	14	11
	25	17	25	24.57	-22	59	23.2	5.824 310	1.51	15.81	15	11	03
	26	17	26	12.04	23	00	09.5	5.836 021	1.51	15.77	15	07	54
	27	17	26	59.91	23	00	55.1	5.847 587	1.50	15.74	15	04	46
	28	17	27	48.18	23	01	40.1	5.859 007	1.50	15.71	15	01	38
	29	17	28	36.85	23	02	24.4	5.870 279	1.50	15.68	14	58	31
	30	17	29	25.90	23	03	08.0	5.881 398	1.50	15.65	14	55	24
	31	17	30	15.34	-23	03	50.8	5.892 364	1.49	15.62	14	52	18
Nov.	1	17	31	05.14	23	04	32.9	5.903 174	1.49	15.59	14	49	12
	2	17	31	55.31	23	05	14.3	5.913 826	1.49	15.57	14	46	06
	3	17	32	45.83	23	05	54.8	5.924 318	1.48	15.54	14	43	01
	4	17	33	36.69	23	06	34.6	5.934 648	1.48	15.51	14	39	55
	5	17	34	27.89	23	07	13.4	5.944 815	1.48	15.49	14	36	51
	6	17	35	19.41	-23	07	51.4	5.954 816	1.48	15.46	14	33	46
	7	17	36	11.26	23	08	28.4	5.964 651	1.47	15.43	14	30	42
	8	17	37	03.43	23	09	04.5	5.974 317	1.47	15.41	14	27	38
	9	17	37	55.91	23	09	39.6	5.983 813	1.47	15.38	14	24	35
	10	17	38	48.70	23	10	13.7	5.993 137	1.47	15.36	14	21	32
	11	17	39	41.78	23	10	46.8	6.002 288	1.47	15.34	14	18	29
	12	17	40	35.17	-23	11	18.8	6.011 265	1.46	15.31	14	15	26
	13	17	41	28.84	23	11	49.8	6.020 066	1.46	15.29	14	12	24
	14	17	42	22.80	23	12	19.7	6.028 690	1.46	15.27	14	09	22
	15	17	43	17.03	23	12	48.6	6.037 134	1.46	15.25	14	06	20
	16	17	44	11.54	-23	13	16.3	6.045 399	1.45	15.23	14	03	18

JUPITER, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	17	44	11.54	-23	13	16.3	6.045 399	1.45	15.23	14	03	18
	17	17	45	06.32	23	13	43.0	6.053 481	1.45	15.21	14	00	17
	18	17	46	01.35	23	14	08.5	6.061 380	1.45	15.19	13	57	16
	19	17	46	56.63	23	14	32.9	6.069 094	1.45	15.17	13	54	15
	20	17	47	52.16	23	14	56.1	6.076 621	1.45	15.15	13	51	15
	21	17	48	47.93	23	15	18.1	6.083 959	1.45	15.13	13	48	15
	22	17	49	43.93	-23	15	38.9	6.091 107	1.44	15.11	13	45	15
	23	17	50	40.16	23	15	58.4	6.098 063	1.44	15.10	13	42	15
	24	17	51	36.61	23	16	16.7	6.104 825	1.44	15.08	13	39	15
	25	17	52	33.29	23	16	33.7	6.111 392	1.44	15.06	13	36	16
	26	17	53	30.17	23	16	49.4	6.117 762	1.44	15.05	13	33	17
	27	17	54	27.27	23	17	03.9	6.123 933	1.44	15.03	13	30	18
	28	17	55	24.56	-23	17	17.0	6.129 904	1.43	15.02	13	27	19
	29	17	56	22.04	23	17	28.9	6.135 674	1.43	15.00	13	24	20
	30	17	57	19.70	23	17	39.4	6.141 241	1.43	14.99	13	21	22
Dec.	1	17	58	17.54	23	17	48.6	6.146 606	1.43	14.98	13	18	24
	2	17	59	15.53	23	17	56.5	6.151 767	1.43	14.96	13	15	25
	3	18	00	13.69	23	18	03.0	6.156 723	1.43	14.95	13	12	28
	4	18	01	11.99	-23	18	08.1	6.161 474	1.43	14.94	13	09	30
	5	18	02	10.44	23	18	11.8	6.166 018	1.43	14.93	13	06	32
	6	18	03	09.03	23	18	14.1	6.170 357	1.43	14.92	13	03	35
	7	18	04	07.75	23	18	15.0	6.174 487	1.42	14.91	13	00	37
	8	18	05	06.59	23	18	14.4	6.178 410	1.42	14.90	12	57	40
	9	18	06	05.56	23	18	12.5	6.182 125	1.42	14.89	12	54	43
	10	18	07	04.65	-23	18	09.0	6.185 632	1.42	14.88	12	51	46
	11	18	08	03.86	23	18	04.2	6.188 929	1.42	14.87	12	48	49
	12	18	09	03.17	23	17	57.9	6.192 016	1.42	14.87	12	45	52
	13	18	10	02.58	23	17	50.1	6.194 894	1.42	14.86	12	42	55
	14	18	11	02.08	23	17	41.0	6.197 561	1.42	14.85	12	39	59
	15	18	12	01.67	23	17	30.4	6.200 017	1.42	14.85	12	37	02
	16	18	13	01.34	-23	17	18.4	6.202 262	1.42	14.84	12	34	05
	17	18	14	01.08	23	17	04.9	6.204 294	1.42	14.84	12	31	09
	18	18	15	00.89	23	16	50.0	6.206 113	1.42	14.83	12	28	13
	19	18	16	00.77	23	16	33.6	6.207 719	1.42	14.83	12	25	16
	20	18	17	00.70	23	16	15.7	6.209 110	1.42	14.83	12	22	20
	21	18	18	00.68	23	15	56.3	6.210 285	1.42	14.82	12	19	24
	22	18	19	00.71	-23	15	35.4	6.211 245	1.42	14.82	12	16	28
	23	18	20	00.79	23	15	13.1	6.211 988	1.42	14.82	12	13	32
	24	18	21	00.91	23	14	49.3	6.212 515	1.42	14.82	12	10	36
	25	18	22	01.05	23	14	24.0	6.212 823	1.42	14.82	12	07	40
	26	18	23	01.22	23	13	57.3	6.212 914	1.42	14.82	12	04	44
	27	18	24	01.42	23	13	29.1	6.212 788	1.42	14.82	12	01	48
	28	18	25	01.43	-23	12	58.8	6.212 443	1.42	14.82	11	58	51
	29	18	26	01.70	23	12	28.6	6.211 881	1.42	14.82	11	55	55
	30	18	27	01.88	23	11	56.2	6.211 101	1.42	14.82	11	52	59
	31	18	28	02.02	23	11	22.3	6.210 104	1.42	14.82	11	50	03
	32	18	29	02.14	-23	10	47.0	6.208 890	1.42	14.83	11	47	07

SATURN, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude ° ′ ″	Heliocentric Latitude ° ′ ″	Radius Vector	Date	Heliocentric Longitude ° ′ ″	Heliocentric Latitude ° ′ ″	Radius Vector
Jan. 1	281 29 52.8	+0 31 48.8	10.060 259	Apr. 3	284 16 12.2	+0 24 44.1	10.055 753
3	281 33 29.7	0 31 39.6	10.060 175	5	284 19 49.2	0 24 34.8	10.055 640
5	281 37 06.5	0 31 30.4	10.060 091	7	284 23 26.3	0 24 25.5	10.055 526
7	281 40 43.4	0 31 21.3	10.060 006	9	284 27 03.3	0 24 16.2	10.055 411
9	281 44 20.3	0 31 12.0	10.059 921	11	284 30 40.4	0 24 06.9	10.055 296
11	281 47 57.1	0 31 02.9	10.059 835	13	284 34 17.5	0 23 57.6	10.055 181
13	281 51 34.0	+0 30 53.6	10.059 748	15	284 37 54.5	+0 23 48.3	10.055 064
15	281 55 10.9	0 30 44.5	10.059 661	17	284 41 31.6	0 23 39.0	10.054 947
17	281 58 47.8	0 30 35.2	10.059 573	19	284 45 08.7	0 23 29.8	10.054 829
19	282 02 24.6	0 30 26.0	10.059 484	21	284 48 45.8	0 23 20.5	10.054 711
21	282 06 01.5	0 30 16.9	10.059 395	23	284 52 22.9	0 23 11.1	10.054 592
23	282 09 38.4	0 30 07.6	10.059 305	25	284 55 60.0	0 23 01.9	10.054 472
25	282 13 15.3	+0 29 58.4	10.059 214	27	284 59 37.1	+0 22 52.6	10.054 352
27	282 16 52.2	0 29 49.2	10.059 123	29	285 03 14.2	0 22 43.2	10.054 231
29	282 20 29.1	0 29 40.0	10.059 031	May 1	285 06 51.3	0 22 34.0	10.054 110
31	282 24 06.0	0 29 30.8	10.058 939	3	285 10 28.4	0 22 24.6	10.053 987
Feb. 2	282 27 42.9	0 29 21.6	10.058 846	5	285 14 05.6	0 22 15.3	10.053 864
4	282 31 19.8	0 29 12.3	10.058 752	7	285 17 42.7	0 22 06.0	10.053 741
6	282 34 56.7	+0 29 03.1	10.058 658	9	285 21 19.8	+0 21 56.7	10.053 617
8	282 38 33.6	0 28 53.9	10.058 563	11	285 24 57.0	0 21 47.4	10.053 492
10	282 42 10.5	0 28 44.7	10.058 467	13	285 28 34.1	0 21 38.1	10.053 366
12	282 45 47.5	0 28 35.4	10.058 371	15	285 32 11.3	0 21 28.8	10.053 240
14	282 49 24.4	0 28 26.2	10.058 274	17	285 35 48.5	0 21 19.4	10.053 113
16	282 53 01.4	0 28 17.0	10.058 176	19	285 39 25.6	0 21 10.1	10.052 986
18	282 56 38.3	+0 28 07.7	10.058 078	21	285 43 02.8	+0 21 00.8	10.052 858
20	283 00 15.2	0 27 58.5	10.057 979	23	285 46 39.9	0 20 51.5	10.052 729
22	283 03 52.2	0 27 49.3	10.057 879	25	285 50 17.1	0 20 42.2	10.052 600
24	283 07 29.2	0 27 40.0	10.057 779	27	285 53 54.3	0 20 32.8	10.052 470
26	283 11 06.1	0 27 30.8	10.057 678	29	285 57 31.5	0 20 23.5	10.052 339
28	283 14 43.1	0 27 21.5	10.057 577	31	286 01 08.7	0 20 14.2	10.052 208
Mar. 2	283 18 20.0	+0 27 12.3	10.057 475	June 2	286 04 45.9	+0 20 04.9	10.052 076
4	283 21 57.0	0 27 03.0	10.057 372	4	286 08 23.1	0 19 55.5	10.051 943
6	283 25 34.0	0 26 53.8	10.057 269	6	286 12 00.3	0 19 46.2	10.051 810
8	283 29 11.0	0 26 44.5	10.057 165	8	286 15 37.5	0 19 36.9	10.051 676
10	283 32 48.0	0 26 35.2	10.057 060	10	286 19 14.8	0 19 27.5	10.051 541
12	283 36 24.9	0 26 26.0	10.056 954	12	286 22 52.0	0 19 18.2	10.051 406
14	283 40 01.9	+0 26 16.7	10.056 848	14	286 26 29.2	+0 19 08.9	10.051 270
16	283 43 39.0	0 26 07.5	10.056 742	16	286 30 06.5	0 18 59.5	10.051 134
18	283 47 16.0	0 25 58.2	10.056 635	18	286 33 43.7	0 18 50.2	10.050 997
20	283 50 53.0	0 25 49.0	10.056 527	20	286 37 21.0	0 18 40.8	10.050 859
22	283 54 30.0	0 25 39.7	10.056 418	22	286 40 58.2	0 18 31.5	10.050 720
24	283 58 07.0	0 25 30.4	10.056 309	24	286 44 35.5	0 18 22.1	10.050 581
26	284 01 44.0	+0 25 21.1	10.056 199	26	286 48 12.8	+0 18 12.8	10.050 442
28	284 05 21.0	0 25 11.9	10.056 088	28	286 51 50.0	0 18 03.4	10.050 301
30	284 08 58.1	0 25 02.6	10.055 977	30	286 55 27.3	0 17 54.1	10.050 160
Apr. 1	284 12 35.1	0 24 53.3	10.055 865	July 2	286 59 04.6	0 17 44.7	10.050 019
3	284 16 12.2	+0 24 44.1	10.055 753	4	287 02 41.9	+0 17 35.4	10.049 876

SATURN, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date		Heliocentric Longitude	Heliocentric Latitude	Radius Vector
		° ′ ″	° ′ ″				° ′ ″	° ′ ″	
July	2	286 59 04.6	+0 17 44.7	10.050 019	Oct.	2	289 45 47.0	+0 10 33.1	10.042 808
	4	287 02 41.9	0 17 35.4	10.049 876		4	289 49 24.6	0 10 23.7	10.042 636
	6	287 06 19.2	0 17 26.0	10.049 733		6	289 53 02.2	0 10 14.3	10.042 464
	8	287 09 56.5	0 17 16.7	10.049 590		8	289 56 39.8	0 10 04.9	10.042 290
	10	287 13 33.8	0 17 07.3	10.049 446		10	290 00 17.4	0 09 55.4	10.042 117
	12	287 17 11.2	0 16 57.9	10.049 301		12	290 03 55.1	0 09 46.0	10.041 942
	14	287 20 48.5	+0 16 48.6	10.049 155		14	290 07 32.7	+0 09 36.6	10.041 767
	16	287 24 25.8	0 16 39.2	10.049 009		16	290 11 10.4	0 09 27.2	10.041 591
	18	287 28 03.2	0 16 29.9	10.048 862		18	290 14 48.0	0 09 17.8	10.041 415
	20	287 31 40.5	0 16 20.5	10.048 715		20	290 18 25.7	0 09 08.4	10.041 238
	22	287 35 17.8	0 16 11.1	10.048 567		22	290 22 03.4	0 08 58.9	10.041 060
	24	287 38 55.2	0 16 01.7	10.048 418		24	290 25 41.1	0 08 49.5	10.040 882
	26	287 42 32.5	+0 15 52.4	10.048 269		26	290 29 18.8	+0 08 40.1	10.040 703
	28	287 46 09.9	0 15 43.0	10.048 119		28	290 32 56.5	0 08 30.7	10.040 523
	30	287 49 47.3	0 15 33.6	10.047 968		30	290 36 34.1	0 08 21.2	10.040 343
Aug.	1	287 53 24.7	0 15 24.3	10.047 817	Nov.	1	290 40 11.9	0 08 11.8	10.040 162
	3	287 57 02.1	0 15 14.9	10.047 665		3	290 43 49.6	0 08 02.4	10.039 980
	5	288 00 39.5	0 15 05.5	10.047 512		5	290 47 27.3	0 07 53.0	10.039 798
	7	288 04 16.9	+0 14 56.1	10.047 359		7	290 51 05.0	+0 07 43.6	10.039 615
	9	288 07 54.3	0 14 46.8	10.047 205		9	290 54 42.8	0 07 34.1	10.039 432
	11	288 11 31.7	0 14 37.4	10.047 051		11	290 58 20.5	0 07 24.7	10.039 248
	13	288 15 09.1	0 14 28.0	10.046 895		13	291 01 58.3	0 07 15.3	10.039 063
	15	288 18 46.6	0 14 18.6	10.046 740		15	291 05 36.1	0 07 05.8	10.038 877
	17	288 22 24.0	0 14 09.2	10.046 583		17	291 09 13.9	0 06 56.4	10.038 691
	19	288 26 01.4	+0 13 59.8	10.046 426		19	291 12 51.7	+0 06 47.0	10.038 505
	21	288 29 38.9	0 13 50.5	10.046 268		21	291 16 29.4	0 06 37.5	10.038 317
	23	288 33 16.4	0 13 41.1	10.046 110		23	291 20 07.2	0 06 28.1	10.038 129
	25	288 36 53.8	0 13 31.7	10.045 951		25	291 23 45.1	0 06 18.7	10.037 941
	27	288 40 31.3	0 13 22.3	10.045 791		27	291 27 22.9	0 06 09.2	10.037 751
	29	288 44 08.7	0 13 12.9	10.045 631		29	291 31 00.7	0 05 59.8	10.037 561
	31	288 47 46.2	+0 13 03.5	10.045 470	Dec.	1	291 34 38.5	+0 05 50.4	10.037 371
Sept.	2	288 51 23.7	0 12 54.1	10.045 309		3	291 38 16.4	0 05 40.9	10.037 179
	4	288 55 01.2	0 12 44.7	10.045 146		5	291 41 54.2	0 05 31.5	10.036 988
	6	288 58 38.7	0 12 35.3	10.044 984		7	291 45 32.1	0 05 22.0	10.036 795
	8	289 02 16.2	0 12 25.9	10.044 820		9	291 49 09.9	0 05 12.6	10.036 602
	10	289 05 53.8	0 12 16.5	10.044 656		11	291 52 47.8	0 05 03.2	10.036 408
	12	289 09 31.3	+0 12 07.1	10.044 491		13	291 56 25.7	+0 04 53.7	10.036 214
	14	289 13 08.8	0 11 57.7	10.044 326		15	292 00 03.6	0 04 44.3	10.036 019
	16	289 16 46.4	0 11 48.3	10.044 160		17	292 03 41.5	0 04 34.9	10.035 823
	18	289 20 23.9	0 11 38.9	10.043 993		19	292 07 19.4	0 04 25.4	10.035 626
	20	289 24 01.5	0 11 29.5	10.043 826		21	292 10 57.3	0 04 16.0	10.035 429
	22	289 27 39.0	0 11 20.1	10.043 658		23	292 14 35.2	0 04 06.5	10.035 232
	24	289 31 16.6	+0 11 10.7	10.043 489		25	292 18 13.2	+0 03 57.1	10.035 033
	26	289 34 54.2	0 11 01.3	10.043 320		27	292 21 51.1	0 03 47.6	10.034 835
	28	289 38 31.8	0 10 51.9	10.043 150		29	292 25 29.1	0 03 38.2	10.034 635
	30	289 42 09.3	0 10 42.5	10.042 979		31	292 29 07.0	0 03 28.7	10.034 435
Oct.	2	289 45 47.0	+0 10 33.1	10.042 808		33	292 32 45.0	+0 03 19.3	10.034 234

SATURN, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Jan.	0	281	15	30.4	+0	29	03.6
	1	281	22	35.9	0	28	59.4
	2	281	29	41.5	0	28	55.8
	3	281	36	46.4	0	28	51.1
	4	281	43	52.3	0	28	46.8
	5	281	50	57.9	0	28	42.6
	6	281	58	03.4	+0	28	38.5
	7	282	05	08.5	0	28	34.5
	8	282	12	13.3	0	28	30.5
	9	282	19	17.7	0	28	26.6
	10	282	26	21.5	0	28	22.7
	11	282	33	24.8	0	28	18.8
	12	282	40	27.4	+0	28	15.0
	13	282	47	29.3	0	28	11.2
	14	282	54	30.4	0	28	07.4
	15	283	01	30.7	0	28	03.7
	16	283	08	30.1	0	28	00.0
	17	283	15	28.6	0	27	56.4
	18	283	22	26.1	+0	27	52.8
	19	283	29	22.6	0	27	49.2
	20	283	36	17.9	0	27	45.7
	21	283	43	12.0	0	27	42.2
	22	283	50	04.8	0	27	38.8
	23	283	56	56.1	0	27	35.4
	24	284	03	46.0	+0	27	32.0
	25	284	10	34.3	0	27	28.6
	26	284	17	21.1	0	27	25.3
	27	284	24	06.3	0	27	22.0
	28	284	30	49.9	0	27	18.7
	29	284	37	31.7	0	27	15.5
	30	284	44	11.8	+0	27	12.3
	31	284	50	50.0	0	27	09.1
Feb.	1	284	57	26.3	0	27	06.0
	2	285	04	00.5	0	27	02.8
	3	285	10	32.6	0	26	59.8
	4	285	17	02.5	0	26	56.7
	5	285	23	30.2	+0	26	53.7
	6	285	29	55.4	0	26	50.7
	7	285	36	18.2	0	26	47.7
	8	285	42	38.5	0	26	44.7
	9	285	48	56.3	0	26	41.8
	10	285	55	11.4	0	26	38.9
	11	286	01	23.9	+0	26	36.1
	12	286	07	33.7	0	26	33.2
	13	286	13	40.7	0	26	30.4
	14	286	19	44.9	0	26	27.7
	15	286	25	46.2	+0	26	24.9

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Feb.	15	286	25	46.2	+0	26	24.9
	16	286	31	44.6	0	26	22.2
	17	286	37	39.9	0	26	19.5
	18	286	43	32.0	0	26	16.8
	19	286	49	21.0	0	26	14.2
	20	286	55	06.7	0	26	11.5
	21	287	00	49.1	+0	26	08.9
	22	287	06	28.1	0	26	06.3
	23	287	12	03.7	0	26	03.8
	24	287	17	35.9	0	26	01.2
	25	287	23	04.7	0	25	58.7
	26	287	28	29.9	0	25	56.1
	27	287	33	51.4	+0	25	53.6
	28	287	39	09.3	0	25	51.1
Mar.	1	287	44	23.5	0	25	48.7
	2	287	49	33.7	0	25	46.2
	3	287	54	40.1	0	25	43.8
	4	287	59	42.4	0	25	41.3
	5	288	04	40.7	+0	25	38.9
	6	288	09	34.8	0	25	36.5
	7	288	14	24.7	0	25	34.2
	8	288	19	10.4	0	25	31.8
	9	288	23	51.8	0	25	29.5
	10	288	28	28.9	0	25	27.1
	11	288	33	01.6	+0	25	24.8
	12	288	37	29.9	0	25	22.5
	13	288	41	53.8	0	25	20.2
	14	288	46	13.1	0	25	18.0
	15	288	50	27.9	0	25	15.7
	16	288	54	38.0	0	25	13.4
	17	288	58	43.4	+0	25	11.2
	18	289	02	44.1	0	25	09.0
	19	289	06	39.9	0	25	06.7
	20	289	10	30.9	0	25	04.5
	21	289	14	16.9	0	25	02.3
	22	289	17	58.1	0	25	00.1
	23	289	21	34.3	+0	24	57.9
	24	289	25	05.6	0	24	55.7
	25	289	28	31.9	0	24	53.4
	26	289	31	53.1	0	24	51.2
	27	289	35	09.2	0	24	49.0
	28	289	38	20.2	0	24	46.8
	29	289	41	25.9	+0	24	44.6
	30	289	44	26.3	0	24	42.4
	31	289	47	21.3	0	24	40.2
Apr.	1	289	50	11.0	0	24	38.0
	2	289	52	55.2	+0	24	35.8

SATURN, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	289	50	11.0	+0	24	38.0	May	17	290	17	14.8	+0	22	44.0
	2	289	52	55.2	0	24	35.8		18	290	15	35.4	0	22	41.0
	3	289	55	33.9	0	24	33.5		19	290	13	50.6	0	22	37.9
	4	289	58	07.1	0	24	31.3		20	290	12	00.6	0	22	34.8
	5	290	00	34.8	0	24	29.1		21	290	10	05.4	0	22	31.6
	6	290	02	56.9	0	24	26.9		22	290	08	04.9	0	22	28.5
	7	290	05	13.4	+0	24	24.7		23	290	05	59.3	+0	22	25.3
	8	290	07	24.3	0	24	22.5		24	290	03	48.5	0	22	22.0
	9	290	09	29.7	0	24	20.3		25	290	01	32.7	0	22	18.7
	10	290	11	29.3	0	24	18.0		26	289	59	11.8	0	22	15.4
	11	290	13	23.4	0	24	15.8		27	289	56	46.0	0	22	12.0
	12	290	15	11.7	0	24	13.6		28	289	54	15.2	0	22	08.6
	13	290	16	54.3	+0	24	11.3		29	289	51	39.6	+0	22	05.2
	14	290	18	31.1	0	24	09.1		30	289	48	59.3	0	22	01.7
	15	290	20	02.1	0	24	06.8		31	289	46	14.3	0	21	58.2
	16	290	21	27.2	0	24	04.5	June	1	289	43	24.8	0	21	54.7
	17	290	22	46.6	0	24	02.2		2	289	40	30.8	0	21	51.1
	18	290	24	00.1	0	23	59.9		3	289	37	32.4	0	21	47.5
	19	290	25	07.8	+0	23	57.6		4	289	34	29.7	+0	21	43.9
	20	290	26	09.7	0	23	55.2		5	289	31	22.8	0	21	40.2
	21	290	27	05.9	0	23	52.8		6	289	28	11.8	0	21	36.4
	22	290	27	56.3	0	23	50.5		7	289	24	56.7	0	21	32.6
	23	290	28	40.8	0	23	48.1		8	289	21	37.7	0	21	28.8
	24	290	29	19.5	0	23	45.6		9	289	18	14.7	0	21	24.9
	25	290	29	52.4	+0	23	43.2		10	289	14	47.9	+0	21	21.0
	26	290	30	19.3	0	23	40.7		11	289	11	17.5	0	21	17.1
	27	290	30	40.3	0	23	38.3		12	289	07	43.6	0	21	13.1
	28	290	30	55.3	0	23	35.8		13	289	04	06.3	0	21	09.0
	29	290	31	04.5	0	23	33.3		14	289	00	25.7	0	21	04.9
	30	290	31	07.7	0	23	30.7		15	288	56	42.0	0	21	00.8
May	1	290	31	04.9	+0	23	28.2		16	288	52	55.2	+0	20	56.6
	2	290	30	56.3	0	23	25.6		17	288	49	05.4	0	20	52.3
	3	290	30	41.8	0	23	23.0		18	288	45	12.8	0	20	48.0
	4	290	30	21.4	0	23	20.4		19	288	41	17.4	0	20	43.7
	5	290	29	55.2	0	23	17.8		20	288	37	19.3	0	20	39.3
	6	290	29	23.2	0	23	15.1		21	288	33	18.6	0	20	34.9
	7	290	28	45.4	+0	23	12.4		22	288	29	15.4	+0	20	30.5
	8	290	28	01.9	0	23	09.7		23	288	25	09.8	0	20	26.0
	9	290	27	12.6	0	23	07.0		24	288	21	02.0	0	20	21.4
	10	290	26	17.7	0	23	04.2		25	288	16	52.1	0	20	16.8
	11	290	25	17.0	0	23	01.4		26	288	12	40.2	0	20	12.2
	12	290	24	10.6	0	22	58.6		27	288	08	26.5	0	20	07.5
	13	290	22	58.5	+0	22	55.7		28	288	04	11.0	+0	20	02.8
	14	290	21	40.8	0	22	52.9		29	287	59	54.0	0	19	58.1
	15	290	20	17.6	0	22	49.9		30	287	55	35.6	0	19	53.3
	16	290	18	48.9	0	22	47.0	July	1	287	51	15.9	0	19	48.5
	17	290	17	14.8	+0	22	44.0		2	287	46	55.0	+0	19	43.6

SATURN, 2019
GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	287	51	15.9	+0	19	48.5	Aug.	16	284	46	32.1	+0	15	29.7
	2	287	46	55.0	0	19	43.6		17	284	43	36.0	0	15	23.5
	3	287	42	33.1	0	19	38.7		18	284	40	44.2	0	15	17.4
	4	287	38	10.3	0	19	33.8		19	284	37	57.0	0	15	11.2
	5	287	33	46.7	0	19	28.8		20	284	35	14.3	0	15	05.0
	6	287	29	22.4	0	19	23.8		21	284	32	36.2	0	14	58.9
	7	287	24	57.5	+0	19	18.7		22	284	30	03.0	+0	14	52.7
	8	287	20	32.3	0	19	13.6		23	284	27	34.5	0	14	46.5
	9	287	16	06.9	0	19	08.4		24	284	25	11.0	0	14	40.3
	10	287	11	41.4	0	19	03.2		25	284	22	52.5	0	14	34.1
	11	287	07	16.0	0	18	58.0		26	284	20	39.0	0	14	28.0
	12	287	02	50.8	0	18	52.7		27	284	18	30.6	0	14	21.8
	13	286	58	26.0	+0	18	47.4		28	284	16	27.4	+0	14	15.6
	14	286	54	01.7	0	18	42.0		29	284	14	29.4	0	14	09.4
	15	286	49	38.0	0	18	36.6		30	284	12	36.6	0	14	03.2
	16	286	45	15.1	0	18	31.2		31	284	10	49.1	0	13	57.0
	17	286	40	52.9	0	18	25.7	Sept.	1	284	09	07.0	0	13	50.8
	18	286	36	31.7	0	18	20.2		2	284	07	30.3	0	13	44.6
	19	286	32	11.5	+0	18	14.7		3	284	05	59.1	+0	13	38.4
	20	286	27	52.5	0	18	09.1		4	284	04	33.6	0	13	32.2
	21	286	23	34.8	0	18	03.5		5	284	03	13.7	0	13	26.0
	22	286	19	18.6	0	17	57.9		6	284	01	59.5	0	13	19.8
	23	286	15	03.9	0	17	52.3		7	284	00	50.9	0	13	13.7
	24	286	10	51.0	0	17	46.6		8	283	59	48.0	0	13	07.5
	25	286	06	39.9	+0	17	40.9		9	283	58	50.9	+0	13	01.3
	26	286	02	30.8	0	17	35.2		10	283	57	59.4	0	12	55.1
	27	285	58	23.8	0	17	29.4		11	283	57	13.7	0	12	49.0
	28	285	54	19.1	0	17	23.6		12	283	56	33.7	0	12	42.8
	29	285	50	16.8	0	17	17.8		13	283	55	59.4	0	12	36.7
	30	285	46	17.0	0	17	12.0		14	283	55	30.9	0	12	30.6
	31	285	42	19.8	+0	17	06.2		15	283	55	08.2	+0	12	24.5
Aug.	1	285	38	25.3	0	17	00.3		16	283	54	51.4	0	12	18.4
	2	285	34	33.7	0	16	54.4		17	283	54	40.4	0	12	12.3
	3	285	30	44.9	0	16	48.5		18	283	54	35.2	0	12	06.2
	4	285	26	59.2	0	16	42.5		19	283	54	36.0	0	12	00.2
	5	285	23	16.7	0	16	36.6		20	283	54	42.7	0	11	54.1
	6	285	19	37.5	+0	16	30.6		21	283	54	55.4	+0	11	48.1
	7	285	16	01.8	0	16	24.6		22	283	55	14.0	0	11	42.1
	8	285	12	29.7	0	16	18.5		23	283	55	38.5	0	11	36.1
	9	285	09	01.3	0	16	12.5		24	283	56	09.0	0	11	30.1
	10	285	05	36.6	0	16	06.4		25	283	56	45.3	0	11	24.2
	11	285	02	15.8	0	16	00.3		26	283	57	27.6	0	11	18.2
	12	284	58	59.0	+0	15	54.2		27	283	58	15.7	+0	11	12.3
	13	284	55	46.1	0	15	48.1		28	283	59	09.7	0	11	06.4
	14	284	52	37.3	0	15	42.0		29	284	00	09.6	0	11	00.4
	15	284	49	32.6	0	15	35.8		30	284	01	15.5	0	10	54.5
	16	284	46	32.1	+0	15	29.7	Oct.	1	284	02	27.3	+0	10	48.7

SATURN, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	284	02	27.3	+0	10	48.7	Nov.	16	286	35	04.0	+0	06	39.1
	2	284	03	45.1	0	10	42.8		17	286	40	14.2	0	06	34.2
	3	284	05	08.8	0	10	36.9		18	286	45	28.3	0	06	29.3
	4	284	06	38.4	0	10	31.1		19	286	50	46.2	0	06	24.3
	5	284	08	13.8	0	10	25.3		20	286	56	07.8	0	06	19.5
	6	284	09	55.0	0	10	19.5		21	287	01	33.0	0	06	14.6
	7	284	11	42.0	+0	10	13.7		22	287	07	01.9	+0	06	09.7
	8	284	13	34.6	0	10	07.9		23	287	12	34.4	0	06	04.8
	9	284	15	33.0	0	10	02.2		24	287	18	10.5	0	06	00.0
	10	284	17	37.0	0	09	56.5		25	287	23	50.0	0	05	55.2
	11	284	19	46.6	0	09	50.8		26	287	29	33.1	0	05	50.4
	12	284	22	01.8	0	09	45.1		27	287	35	19.5	0	05	45.6
	13	284	24	22.6	+0	09	39.4		28	287	41	09.3	+0	05	40.8
	14	284	26	48.9	0	09	33.8		29	287	47	02.3	0	05	36.0
	15	284	29	20.8	0	09	28.2		30	287	52	58.4	0	05	31.3
	16	284	31	58.2	0	09	22.6	Dec.	1	287	58	57.6	0	05	26.5
	17	284	34	41.1	0	09	17.0		2	288	04	59.7	0	05	21.8
	18	284	37	29.4	0	09	11.5		3	288	11	04.7	0	05	17.1
	19	284	40	23.2	+0	09	06.0		4	288	17	12.5	+0	05	12.4
	20	284	43	22.4	0	09	00.5		5	288	23	23.1	0	05	07.8
	21	284	46	26.9	0	08	55.0		6	288	29	36.3	0	05	03.1
	22	284	49	36.6	0	08	49.5		7	288	35	52.2	0	04	58.5
	23	284	52	51.6	0	08	44.1		8	288	42	10.7	0	04	53.8
	24	284	56	11.8	0	08	38.6		9	288	48	31.7	0	04	49.2
	25	284	59	37.1	+0	08	33.2		10	288	54	55.2	+0	04	44.7
	26	285	03	07.5	0	08	27.8		11	289	01	21.1	0	04	40.1
	27	285	06	43.0	0	08	22.5		12	289	07	49.4	0	04	35.5
	28	285	10	23.6	0	08	17.1		13	289	14	20.0	0	04	31.0
	29	285	14	09.2	0	08	11.8		14	289	20	52.7	0	04	26.5
	30	285	17	59.9	0	08	06.5		15	289	27	27.6	0	04	21.9
	31	285	21	55.5	+0	08	01.1		16	289	34	04.5	+0	04	17.4
Nov.	1	285	25	56.0	0	07	55.9		17	289	40	43.4	0	04	12.9
	2	285	30	01.3	0	07	50.6		18	289	47	24.2	0	04	08.4
	3	285	34	11.3	0	07	45.4		19	289	54	06.8	0	04	04.0
	4	285	38	25.9	0	07	40.1		20	290	00	51.2	0	03	59.5
	5	285	42	45.1	0	07	34.9		21	290	07	37.4	0	03	55.0
	6	285	47	08.9	+0	07	29.8		22	290	14	25.2	+0	03	50.6
	7	285	51	37.1	0	07	24.6		23	290	21	14.8	0	03	46.1
	8	285	56	09.7	0	07	19.5		24	290	28	05.9	0	03	41.7
	9	286	00	46.6	0	07	14.3		25	290	34	58.6	0	03	37.2
	10	286	05	27.9	0	07	09.3		26	290	41	52.6	0	03	32.8
	11	286	10	13.5	0	07	04.2		27	290	48	48.0	0	03	28.4
	12	286	15	03.3	+0	06	59.1		28	290	55	44.6	+0	03	24.0
	13	286	19	57.3	0	06	54.1		29	291	02	42.4	0	03	19.5
	14	286	24	55.5	0	06	49.1		30	291	09	41.1	0	03	15.2
	15	286	29	57.7	0	06	44.1		31	291	16	40.9	0	03	10.8
	16	286	35	04.0	+0	06	39.1		32	291	23	41.6	+0	03	06.4

SATURN, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	18	48	47.31	-22	28	33.0	11.042 911	0.80	6.68	12	09	34
	1	18	49	17.93	22	28	01.2	11.043 324	0.80	6.68	12	06	08
	2	18	49	48.54	22	27	28.4	11.043 475	0.80	6.68	12	02	43
	3	18	50	19.11	22	26	56.4	11.043 362	0.80	6.68	11	59	18
	4	18	50	49.73	22	26	23.7	11.042 986	0.80	6.68	11	55	52
	5	18	51	20.34	22	25	50.4	11.042 347	0.80	6.69	11	52	27
	6	18	51	50.93	-22	25	16.7	11.041 445	0.80	6.69	11	49	01
	7	18	52	21.49	22	24	42.6	11.040 279	0.80	6.69	11	45	36
	8	18	52	52.02	22	24	08.2	11.038 851	0.80	6.69	11	42	10
	9	18	53	22.52	22	23	33.4	11.037 161	0.80	6.69	11	38	44
	10	18	53	52.97	22	22	58.3	11.035 209	0.80	6.69	11	35	19
	11	18	54	23.38	22	22	22.8	11.032 995	0.80	6.69	11	31	53
	12	18	54	53.74	-22	21	46.9	11.030 521	0.80	6.69	11	28	27
	13	18	55	24.04	22	21	10.7	11.027 788	0.80	6.69	11	25	02
	14	18	55	54.28	22	20	34.2	11.024 796	0.80	6.70	11	21	36
	15	18	56	24.45	22	19	57.4	11.021 547	0.80	6.70	11	18	10
	16	18	56	54.56	22	19	20.2	11.018 041	0.80	6.70	11	14	44
	17	18	57	24.60	22	18	42.7	11.014 280	0.80	6.70	11	11	18
	18	18	57	54.56	-22	18	04.9	11.010 265	0.80	6.70	11	07	52
	19	18	58	24.45	22	17	26.9	11.005 997	0.80	6.71	11	04	25
	20	18	58	54.24	22	16	48.6	11.001 477	0.80	6.71	11	00	59
	21	18	59	23.94	22	16	10.1	10.996 707	0.80	6.71	10	57	33
	22	18	59	53.55	22	15	31.3	10.991 687	0.80	6.72	10	54	06
	23	19	00	23.04	22	14	52.4	10.986 419	0.80	6.72	10	50	40
	24	19	00	52.43	-22	14	13.2	10.980 904	0.80	6.72	10	47	13
	25	19	01	21.70	22	13	33.8	10.975 142	0.80	6.73	10	43	46
	26	19	01	50.86	22	12	54.1	10.969 134	0.80	6.73	10	40	19
	27	19	02	19.90	22	12	14.3	10.962 882	0.80	6.73	10	36	52
	28	19	02	48.81	22	11	34.2	10.956 387	0.80	6.74	10	33	25
	29	19	03	17.60	22	10	54.0	10.949 649	0.80	6.74	10	29	57
	30	19	03	46.25	-22	10	13.7	10.942 670	0.80	6.75	10	26	30
	31	19	04	14.77	22	09	33.2	10.935 451	0.80	6.75	10	23	02
Feb.	1	19	04	43.14	22	08	52.5	10.927 995	0.80	6.76	10	19	35
	2	19	05	11.37	22	08	11.8	10.920 302	0.81	6.76	10	16	07
	3	19	05	39.43	22	07	31.0	10.912 375	0.81	6.76	10	12	39
	4	19	06	07.34	22	06	50.1	10.904 216	0.81	6.77	10	09	10
	5	19	06	35.07	-22	06	09.2	10.895 825	0.81	6.78	10	05	42
	6	19	07	02.63	22	05	28.2	10.887 207	0.81	6.78	10	02	14
	7	19	07	30.02	22	04	47.2	10.878 362	0.81	6.79	9	58	45
	8	19	07	57.22	22	04	06.1	10.869 294	0.81	6.79	9	55	16
	9	19	08	24.23	22	03	25.0	10.860 004	0.81	6.80	9	51	47
	10	19	08	51.05	22	02	43.8	10.850 496	0.81	6.80	9	48	17
	11	19	09	17.68	-22	02	02.7	10.840 771	0.81	6.81	9	44	48
	12	19	09	44.11	22	01	21.6	10.830 832	0.81	6.82	9	41	18
	13	19	10	10.33	22	00	40.5	10.820 683	0.81	6.82	9	37	48
	14	19	10	36.35	21	59	59.4	10.810 326	0.81	6.83	9	34	18
	15	19	11	02.16	-21	59	18.5	10.799 764	0.81	6.84	9	30	48

SATURN, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	19	11	02.16	-21	59	18.5	10.799 764	0.81	6.84	9	30	48
	16	19	11	27.76	21	58	37.6	10.788 999	0.82	6.84	9	27	17
	17	19	11	53.13	21	57	56.8	10.778 035	0.82	6.85	9	23	47
	18	19	12	18.28	21	57	16.2	10.766 873	0.82	6.86	9	20	16
	19	19	12	43.19	21	56	35.7	10.755 518	0.82	6.86	9	16	44
	20	19	13	07.87	21	55	55.4	10.743 971	0.82	6.87	9	13	13
	21	19	13	32.30	-21	55	15.2	10.732 234	0.82	6.88	9	09	41
	22	19	13	56.49	21	54	35.2	10.720 311	0.82	6.89	9	06	09
	23	19	14	20.44	21	53	55.3	10.708 204	0.82	6.89	9	02	37
	24	19	14	44.13	21	53	15.6	10.695 915	0.82	6.90	8	59	05
	25	19	15	07.58	21	52	36.1	10.683 447	0.82	6.91	8	55	32
	26	19	15	30.77	21	51	56.8	10.670 802	0.82	6.92	8	51	59
	27	19	15	53.70	-21	51	17.8	10.657 984	0.83	6.93	8	48	26
	28	19	16	16.36	21	50	39.1	10.644 995	0.83	6.93	8	44	53
Mar.	1	19	16	38.75	21	50	00.7	10.631 839	0.83	6.94	8	41	19
	2	19	17	00.87	21	49	22.5	10.618 519	0.83	6.95	8	37	45
	3	19	17	22.70	21	48	44.7	10.605 037	0.83	6.96	8	34	10
	4	19	17	44.24	21	48	07.2	10.591 398	0.83	6.97	8	30	36
	5	19	18	05.49	-21	47	30.1	10.577 606	0.83	6.98	8	27	01
	6	19	18	26.44	21	46	53.4	10.563 662	0.83	6.99	8	23	26
	7	19	18	47.09	21	46	17.0	10.549 572	0.83	7.00	8	19	50
	8	19	19	07.43	21	45	41.0	10.535 339	0.83	7.01	8	16	15
	9	19	19	27.47	21	45	05.3	10.520 967	0.84	7.02	8	12	39
	10	19	19	47.20	21	44	30.1	10.506 460	0.84	7.03	8	09	02
	11	19	20	06.61	-21	43	55.3	10.491 821	0.84	7.04	8	05	25
	12	19	20	25.71	21	43	21.0	10.477 056	0.84	7.05	8	01	48
	13	19	20	44.48	21	42	47.1	10.462 167	0.84	7.06	7	58	11
	14	19	21	02.94	21	42	13.6	10.447 159	0.84	7.07	7	54	33
	15	19	21	21.06	21	41	40.7	10.432 036	0.84	7.08	7	50	55
	16	19	21	38.86	21	41	08.3	10.416 803	0.84	7.09	7	47	17
	17	19	21	56.32	-21	40	36.5	10.401 462	0.85	7.10	7	43	38
	18	19	22	13.44	21	40	05.2	10.386 019	0.85	7.11	7	39	59
	19	19	22	30.21	21	39	34.5	10.370 476	0.85	7.12	7	36	20
	20	19	22	46.63	21	39	04.3	10.354 838	0.85	7.13	7	32	40
	21	19	23	02.71	21	38	34.7	10.339 108	0.85	7.14	7	29	00
	22	19	23	18.43	21	38	05.7	10.323 290	0.85	7.15	7	25	20
	23	19	23	33.81	-21	37	37.2	10.307 388	0.85	7.16	7	21	39
	24	19	23	48.83	21	37	09.4	10.291 405	0.85	7.17	7	17	58
	25	19	24	03.49	21	36	42.2	10.275 345	0.86	7.18	7	14	17
	26	19	24	17.79	21	36	15.6	10.259 212	0.86	7.20	7	10	35
	27	19	24	31.73	21	35	49.7	10.243 010	0.86	7.21	7	06	53
	28	19	24	45.30	21	35	24.4	10.226 743	0.86	7.22	7	03	10
	29	19	24	58.50	-21	34	59.9	10.210 415	0.86	7.23	6	59	28
	30	19	25	11.32	21	34	36.1	10.194 030	0.86	7.24	6	55	44
	31	19	25	23.76	21	34	13.0	10.177 593	0.86	7.25	6	52	01
Apr.	1	19	25	35.82	21	33	50.6	10.161 109	0.87	7.26	6	48	17
	2	19	25	47.49	-21	33	29.0	10.144 581	0.87	7.28	6	44	32

SATURN, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	19	25	35.82	-21	33	50.6	10.161 109	0.87	7.26	6	48	17
	2	19	25	47.49	21	33	29.0	10.144 581	0.87	7.28	6	44	32
	3	19	25	58.77	21	33	08.1	10.128 015	0.87	7.29	6	40	47
	4	19	26	09.65	21	32	47.9	10.111 415	0.87	7.30	6	37	02
	5	19	26	20.15	21	32	28.5	10.094 785	0.87	7.31	6	33	17
	6	19	26	30.24	21	32	09.9	10.078 131	0.87	7.32	6	29	31
	7	19	26	39.94	-21	31	52.0	10.061 458	0.87	7.34	6	25	44
	8	19	26	49.25	21	31	34.9	10.044 770	0.88	7.35	6	21	58
	9	19	26	58.16	21	31	18.6	10.028 072	0.88	7.36	6	18	10
	10	19	27	06.66	21	31	03.1	10.011 369	0.88	7.37	6	14	23
	11	19	27	14.77	21	30	48.5	9.994 666	0.88	7.39	6	10	35
	12	19	27	22.47	21	30	34.7	9.977 967	0.88	7.40	6	06	47
	13	19	27	29.76	-21	30	21.7	9.961 278	0.88	7.41	6	02	58
	14	19	27	36.64	21	30	09.6	9.944 603	0.88	7.42	5	59	09
	15	19	27	43.11	21	29	58.4	9.927 946	0.89	7.44	5	55	19
	16	19	27	49.17	21	29	48.0	9.911 312	0.89	7.45	5	51	29
	17	19	27	54.82	21	29	38.5	9.894 706	0.89	7.46	5	47	39
	18	19	28	00.05	21	29	29.9	9.878 132	0.89	7.47	5	43	48
	19	19	28	04.88	-21	29	22.1	9.861 593	0.89	7.49	5	39	57
	20	19	28	09.29	21	29	15.1	9.845 094	0.89	7.50	5	36	05
	21	19	28	13.29	21	29	09.0	9.828 640	0.89	7.51	5	32	13
	22	19	28	16.89	21	29	03.8	9.812 234	0.90	7.52	5	28	21
	23	19	28	20.07	21	28	59.4	9.795 881	0.90	7.54	5	24	28
	24	19	28	22.83	21	28	56.0	9.779 586	0.90	7.55	5	20	35
	25	19	28	25.18	-21	28	53.5	9.763 352	0.90	7.56	5	16	41
	26	19	28	27.12	21	28	51.9	9.747 186	0.90	7.57	5	12	47
	27	19	28	28.63	21	28	51.2	9.731 090	0.90	7.59	5	08	52
	28	19	28	29.73	21	28	51.5	9.715 070	0.91	7.60	5	04	57
	29	19	28	30.40	21	28	52.6	9.699 132	0.91	7.61	5	01	02
	30	19	28	30.65	21	28	54.7	9.683 278	0.91	7.62	4	57	06
May	1	19	28	30.49	-21	28	57.6	9.667 516	0.91	7.64	4	53	10
	2	19	28	29.90	21	29	01.4	9.651 848	0.91	7.65	4	49	14
	3	19	28	28.90	21	29	06.1	9.636 281	0.91	7.66	4	45	17
	4	19	28	27.49	21	29	11.7	9.620 819	0.91	7.67	4	41	19
	5	19	28	25.66	21	29	18.2	9.605 467	0.92	7.69	4	37	21
	6	19	28	23.42	21	29	25.6	9.590 231	0.92	7.70	4	33	23
	7	19	28	20.77	-21	29	33.8	9.575 114	0.92	7.71	4	29	25
	8	19	28	17.72	21	29	43.0	9.560 122	0.92	7.72	4	25	26
	9	19	28	14.26	21	29	53.0	9.545 260	0.92	7.73	4	21	26
	10	19	28	10.39	21	30	04.0	9.530 531	0.92	7.75	4	17	26
	11	19	28	06.12	21	30	15.8	9.515 942	0.92	7.76	4	13	26
	12	19	28	01.45	21	30	28.5	9.501 495	0.93	7.77	4	09	25
	13	19	27	56.37	-21	30	42.1	9.487 196	0.93	7.78	4	05	24
	14	19	27	50.90	21	30	56.6	9.473 049	0.93	7.79	4	01	23
	15	19	27	45.03	21	31	11.8	9.459 057	0.93	7.80	3	57	21
	16	19	27	38.78	21	31	27.9	9.445 224	0.93	7.82	3	53	19
	17	19	27	32.14	-21	31	44.8	9.431 555	0.93	7.83	3	49	16

SATURN, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	19	27	32.14	-21	31	44.8	9.431 555	0.93	7.83	3	49	16
	18	19	27	25.12	21	32	02.5	9.418 052	0.93	7.84	3	45	13
	19	19	27	17.73	21	32	21.0	9.404 721	0.94	7.85	3	41	10
	20	19	27	09.96	21	32	40.2	9.391 564	0.94	7.86	3	37	06
	21	19	27	01.83	21	33	00.3	9.378 586	0.94	7.87	3	33	02
	22	19	26	53.32	21	33	21.2	9.365 791	0.94	7.88	3	28	58
	23	19	26	44.45	-21	33	42.8	9.353 182	0.94	7.89	3	24	53
	24	19	26	35.21	21	34	05.3	9.340 763	0.94	7.90	3	20	48
	25	19	26	25.62	21	34	28.5	9.328 539	0.94	7.91	3	16	43
	26	19	26	15.66	21	34	52.4	9.316 514	0.94	7.92	3	12	37
	27	19	26	05.35	21	35	17.0	9.304 691	0.95	7.93	3	08	30
	28	19	25	54.69	21	35	42.4	9.293 075	0.95	7.94	3	04	24
	29	19	25	43.69	-21	36	08.4	9.281 669	0.95	7.95	3	00	17
	30	19	25	32.35	21	36	35.1	9.270 478	0.95	7.96	2	56	10
	31	19	25	20.69	21	37	02.5	9.259 505	0.95	7.97	2	52	02
June	1	19	25	08.69	21	37	30.4	9.248 755	0.95	7.98	2	47	54
	2	19	24	56.38	21	37	59.0	9.238 231	0.95	7.99	2	43	46
	3	19	24	43.76	21	38	28.2	9.227 936	0.95	8.00	2	39	38
	4	19	24	30.83	-21	38	58.0	9.217 876	0.95	8.01	2	35	29
	5	19	24	17.60	21	39	28.4	9.208 053	0.96	8.02	2	31	20
	6	19	24	04.07	21	39	59.4	9.198 471	0.96	8.03	2	27	10
	7	19	23	50.26	21	40	31.0	9.189 132	0.96	8.03	2	23	01
	8	19	23	36.16	21	41	03.1	9.180 041	0.96	8.04	2	18	51
	9	19	23	21.79	21	41	35.7	9.171 200	0.96	8.05	2	14	41
	10	19	23	07.15	-21	42	08.8	9.162 611	0.96	8.06	2	10	30
	11	19	22	52.24	21	42	42.4	9.154 277	0.96	8.06	2	06	19
	12	19	22	37.08	21	43	16.5	9.146 201	0.96	8.07	2	02	08
	13	19	22	21.68	21	43	50.9	9.138 385	0.96	8.08	1	57	57
	14	19	22	06.04	21	44	25.7	9.130 831	0.96	8.08	1	53	46
	15	19	21	50.18	21	45	01.0	9.123 541	0.96	8.09	1	49	34
	16	19	21	34.10	-21	45	36.6	9.116 517	0.96	8.10	1	45	22
	17	19	21	17.81	21	46	12.5	9.109 762	0.97	8.10	1	41	10
	18	19	21	01.31	21	46	48.8	9.103 277	0.97	8.11	1	36	57
	19	19	20	44.61	21	47	25.5	9.097 065	0.97	8.11	1	32	45
	20	19	20	27.72	21	48	02.5	9.091 127	0.97	8.12	1	28	32
	21	19	20	10.65	21	48	39.8	9.085 467	0.97	8.13	1	24	19
	22	19	19	53.39	-21	49	17.3	9.080 085	0.97	8.13	1	20	06
	23	19	19	35.96	21	49	55.1	9.074 984	0.97	8.13	1	15	53
	24	19	19	18.38	21	50	33.1	9.070 166	0.97	8.14	1	11	40
	25	19	19	00.63	21	51	11.3	9.065 632	0.97	8.14	1	07	26
	26	19	18	42.75	21	51	49.7	9.061 385	0.97	8.15	1	03	12
	27	19	18	24.73	21	52	28.3	9.057 426	0.97	8.15	0	58	58
	28	19	18	06.58	-21	53	06.9	9.053 758	0.97	8.15	0	54	45
	29	19	17	48.33	21	53	45.7	9.050 380	0.97	8.16	0	50	30
	30	19	17	29.97	21	54	24.6	9.047 296	0.97	8.16	0	46	16
July	1	19	17	11.51	21	55	03.6	9.044 507	0.97	8.16	0	42	02
	2	19	16	52.98	-21	55	42.6	9.042 013	0.97	8.16	0	37	48

SATURN, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	19	17	11.51	-21	55	03.6	9.044 507	0.97	8.16	0	42	02
	2	19	16	52.98	21	55	42.6	9.042 013	0.97	8.16	0	37	48
	3	19	16	34.36	21	56	21.7	9.039 815	0.97	8.17	0	33	33
	4	19	16	15.68	21	57	00.8	9.037 916	0.97	8.17	0	29	19
	5	19	15	56.94	21	57	40.0	9.036 315	0.97	8.17	0	25	04
	6	19	15	38.15	21	58	19.2	9.035 012	0.97	8.17	0	20	50
	7	19	15	19.31	-21	58	58.4	9.034 009	0.97	8.17	0	16	35
	8	19	15	00.45	21	59	37.4	9.033 305	0.97	8.17	0	12	20
	9	19	14	41.56	22	00	16.5	9.032 899	0.97	8.17	0	08	06
	10	19	14	22.68	22	00	55.4	9.032 792	0.97	8.17	0	03	51
	11	19	14	03.79	22	01	34.1	9.032 982	0.97	8.17	23	55	22
	12	19	13	44.92	22	02	12.8	9.033 471	0.97	8.17	23	51	07
	13	19	13	26.08	-22	02	51.3	9.034 256	0.97	8.17	23	46	52
	14	19	13	07.26	22	03	29.6	9.035 339	0.97	8.17	23	42	38
	15	19	12	48.49	22	04	07.8	9.036 717	0.97	8.17	23	38	23
	16	19	12	29.77	22	04	45.8	9.038 390	0.97	8.17	23	34	09
	17	19	12	11.10	22	05	23.6	9.040 358	0.97	8.17	23	29	54
	18	19	11	52.50	22	06	01.2	9.042 621	0.97	8.16	23	25	40
	19	19	11	33.97	-22	06	38.6	9.045 176	0.97	8.16	23	21	26
	20	19	11	15.52	22	07	15.8	9.048 025	0.97	8.16	23	17	12
	21	19	10	57.16	22	07	52.7	9.051 165	0.97	8.16	23	12	57
	22	19	10	38.90	22	08	29.3	9.054 596	0.97	8.15	23	08	44
	23	19	10	20.75	22	09	05.6	9.058 318	0.97	8.15	23	04	30
	24	19	10	02.73	22	09	41.6	9.062 328	0.97	8.15	23	00	16
	25	19	09	44.83	-22	10	17.2	9.066 627	0.97	8.14	22	56	02
	26	19	09	27.07	22	10	52.5	9.071 212	0.97	8.14	22	51	49
	27	19	09	09.47	22	11	27.5	9.076 083	0.97	8.13	22	47	36
	28	19	08	52.02	22	12	02.1	9.081 238	0.97	8.13	22	43	23
	29	19	08	34.74	22	12	36.3	9.086 676	0.97	8.12	22	39	10
	30	19	08	17.64	22	13	10.1	9.092 395	0.97	8.12	22	34	57
	31	19	08	00.73	-22	13	43.6	9.098 393	0.97	8.11	22	30	44
Aug.	1	19	07	44.00	22	14	16.7	9.104 669	0.97	8.11	22	26	32
	2	19	07	27.48	22	14	49.5	9.111 219	0.97	8.10	22	22	20
	3	19	07	11.16	22	15	21.8	9.118 043	0.96	8.10	22	18	08
	4	19	06	55.06	22	15	53.6	9.125 136	0.96	8.09	22	13	56
	5	19	06	39.18	22	16	25.0	9.132 496	0.96	8.08	22	09	45
	6	19	06	23.55	-22	16	55.9	9.140 120	0.96	8.08	22	05	34
	7	19	06	08.16	22	17	26.3	9.148 005	0.96	8.07	22	01	23
	8	19	05	53.02	22	17	56.3	9.156 148	0.96	8.06	21	57	12
	9	19	05	38.14	22	18	25.7	9.164 546	0.96	8.05	21	53	01
	10	19	05	23.54	22	18	54.7	9.173 196	0.96	8.05	21	48	51
	11	19	05	09.21	22	19	23.2	9.182 094	0.96	8.04	21	44	41
	12	19	04	55.16	-22	19	51.2	9.191 238	0.96	8.03	21	40	32
	13	19	04	41.39	22	20	18.7	9.200 624	0.96	8.02	21	36	22
	14	19	04	27.91	22	20	45.8	9.210 250	0.95	8.01	21	32	13
	15	19	04	14.73	22	21	12.3	9.220 111	0.95	8.01	21	28	05
	16	19	04	01.85	-22	21	38.3	9.230 206	0.95	8.00	21	23	56

SATURN, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	19	04	01.85	-22	21	38.3	9.230 206	0.95	8.00	21	23	56
	17	19	03	49.28	22	22	03.7	9.240 531	0.95	7.99	21	19	48
	18	19	03	37.02	22	22	28.6	9.251 082	0.95	7.98	21	15	40
	19	19	03	25.08	22	22	53.0	9.261 857	0.95	7.97	21	11	33
	20	19	03	13.47	22	23	16.8	9.272 853	0.95	7.96	21	07	25
	21	19	03	02.19	22	23	40.1	9.284 065	0.95	7.95	21	03	19
	22	19	02	51.25	-22	24	02.7	9.295 490	0.95	7.94	20	59	12
	23	19	02	40.66	22	24	24.8	9.307 126	0.94	7.93	20	55	06
	24	19	02	30.41	22	24	46.3	9.318 969	0.94	7.92	20	51	00
	25	19	02	20.53	22	25	07.3	9.331 015	0.94	7.91	20	46	55
	26	19	02	11.01	22	25	27.7	9.343 260	0.94	7.90	20	42	50
	27	19	02	01.85	22	25	47.6	9.355 701	0.94	7.89	20	38	45
	28	19	01	53.06	-22	26	06.8	9.368 334	0.94	7.88	20	34	41
	29	19	01	44.64	22	26	25.6	9.381 155	0.94	7.87	20	30	37
	30	19	01	36.60	22	26	43.7	9.394 159	0.94	7.86	20	26	33
	31	19	01	28.94	22	27	01.3	9.407 342	0.93	7.85	20	22	30
Sept.	1	19	01	21.66	22	27	18.3	9.420 700	0.93	7.84	20	18	27
	2	19	01	14.77	22	27	34.6	9.434 228	0.93	7.82	20	14	25
	3	19	01	08.28	-22	27	50.3	9.447 920	0.93	7.81	20	10	23
	4	19	01	02.19	22	28	05.4	9.461 773	0.93	7.80	20	06	21
	5	19	00	56.50	22	28	19.9	9.475 782	0.93	7.79	20	02	20
	6	19	00	51.22	22	28	33.8	9.489 941	0.93	7.78	19	58	19
	7	19	00	46.35	22	28	47.1	9.504 247	0.93	7.77	19	54	19
	8	19	00	41.88	22	28	59.8	9.518 694	0.92	7.76	19	50	19
	9	19	00	37.83	-22	29	11.9	9.533 279	0.92	7.74	19	46	19
	10	19	00	34.18	22	29	23.4	9.547 996	0.92	7.73	19	42	20
	11	19	00	30.95	22	29	34.4	9.562 842	0.92	7.72	19	38	21
	12	19	00	28.12	22	29	44.7	9.577 811	0.92	7.71	19	34	23
	13	19	00	25.71	22	29	54.4	9.592 901	0.92	7.70	19	30	25
	14	19	00	23.71	22	30	03.4	9.608 105	0.92	7.68	19	26	27
	15	19	00	22.13	-22	30	11.9	9.623 421	0.91	7.67	19	22	30
	16	19	00	20.96	22	30	19.7	9.638 843	0.91	7.66	19	18	33
	17	19	00	20.22	22	30	26.9	9.654 367	0.91	7.65	19	14	37
	18	19	00	19.90	22	30	33.4	9.669 989	0.91	7.63	19	10	41
	19	19	00	20.00	22	30	39.4	9.685 705	0.91	7.62	19	06	46
	20	19	00	20.52	22	30	44.6	9.701 510	0.91	7.61	19	02	51
	21	19	00	21.48	-22	30	49.3	9.717 400	0.90	7.60	18	58	56
	22	19	00	22.86	22	30	53.3	9.733 370	0.90	7.58	18	55	02
	23	19	00	24.66	22	30	56.8	9.749 416	0.90	7.57	18	51	08
	24	19	00	26.89	22	30	59.6	9.765 533	0.90	7.56	18	47	15
	25	19	00	29.55	22	31	01.8	9.781 717	0.90	7.55	18	43	22
	26	19	00	32.63	22	31	03.4	9.797 962	0.90	7.53	18	39	29
	27	19	00	36.12	-22	31	04.3	9.814 264	0.90	7.52	18	35	37
	28	19	00	40.05	22	31	04.6	9.830 618	0.89	7.51	18	31	45
	29	19	00	44.39	22	31	04.3	9.847 019	0.89	7.50	18	27	54
	30	19	00	49.16	22	31	03.3	9.863 461	0.89	7.48	18	24	03
Oct.	1	19	00	54.36	-22	31	01.6	9.879 939	0.89	7.47	18	20	13

SATURN, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	19	00	54.36	-22	31	01.6	9.879 939	0.89	7.47	18	20	13
	2	19	00	59.99	22	30	59.2	9.896 448	0.89	7.46	18	16	23
	3	19	01	06.04	22	30	56.3	9.912 983	0.89	7.45	18	12	33
	4	19	01	12.51	22	30	52.6	9.929 540	0.89	7.43	18	08	44
	5	19	01	19.40	22	30	48.4	9.946 112	0.88	7.42	18	04	55
	6	19	01	26.71	22	30	43.5	9.962 697	0.88	7.41	18	01	07
	7	19	01	34.43	-22	30	38.0	9.979 288	0.88	7.40	17	57	19
	8	19	01	42.56	22	30	31.9	9.995 881	0.88	7.39	17	53	32
	9	19	01	51.10	22	30	25.1	10.012 472	0.88	7.37	17	49	44
	10	19	02	00.04	22	30	17.6	10.029 057	0.88	7.36	17	45	58
	11	19	02	09.38	22	30	09.5	10.045 631	0.88	7.35	17	42	11
	12	19	02	19.13	22	30	00.7	10.062 189	0.87	7.34	17	38	26
	13	19	02	29.27	-22	29	51.3	10.078 728	0.87	7.32	17	34	40
	14	19	02	39.81	22	29	41.2	10.095 243	0.87	7.31	17	30	55
	15	19	02	50.75	22	29	30.4	10.111 730	0.87	7.30	17	27	10
	16	19	03	02.08	22	29	19.0	10.128 185	0.87	7.29	17	23	26
	17	19	03	13.81	22	29	06.8	10.144 603	0.87	7.28	17	19	42
	18	19	03	25.93	22	28	54.0	10.160 981	0.87	7.27	17	15	58
	19	19	03	38.44	-22	28	40.6	10.177 314	0.86	7.25	17	12	15
	20	19	03	51.33	22	28	26.4	10.193 598	0.86	7.24	17	08	32
	21	19	04	04.60	22	28	11.7	10.209 829	0.86	7.23	17	04	50
	22	19	04	18.25	22	27	56.3	10.226 003	0.86	7.22	17	01	08
	23	19	04	32.28	22	27	40.2	10.242 114	0.86	7.21	16	57	26
	24	19	04	46.67	22	27	23.5	10.258 159	0.86	7.20	16	53	45
	25	19	05	01.43	-22	27	06.1	10.274 134	0.86	7.19	16	50	04
	26	19	05	16.56	22	26	48.0	10.290 033	0.85	7.17	16	46	23
	27	19	05	32.05	22	26	29.2	10.305 851	0.85	7.16	16	42	43
	28	19	05	47.90	22	26	09.6	10.321 585	0.85	7.15	16	39	03
	29	19	06	04.11	22	25	49.4	10.337 230	0.85	7.14	16	35	23
	30	19	06	20.69	22	25	28.5	10.352 780	0.85	7.13	16	31	44
	31	19	06	37.61	-22	25	06.9	10.368 233	0.85	7.12	16	28	05
Nov.	1	19	06	54.88	22	24	44.7	10.383 583	0.85	7.11	16	24	27
	2	19	07	12.50	22	24	21.8	10.398 826	0.85	7.10	16	20	49
	3	19	07	30.45	22	23	58.2	10.413 959	0.84	7.09	16	17	11
	4	19	07	48.73	22	23	33.9	10.428 977	0.84	7.08	16	13	33
	5	19	08	07.34	22	23	09.0	10.443 877	0.84	7.07	16	09	56
	6	19	08	26.27	-22	22	43.3	10.458 655	0.84	7.06	16	06	19
	7	19	08	45.51	22	22	17.0	10.473 308	0.84	7.05	16	02	43
	8	19	09	05.07	22	21	50.0	10.487 831	0.84	7.04	15	59	07
	9	19	09	24.94	22	21	22.3	10.502 222	0.84	7.03	15	55	31
	10	19	09	45.12	22	20	53.9	10.516 477	0.84	7.02	15	51	55
	11	19	10	05.60	22	20	24.8	10.530 593	0.84	7.01	15	48	20
	12	19	10	26.38	-22	19	54.9	10.544 567	0.83	7.00	15	44	45
	13	19	10	47.45	22	19	24.4	10.558 394	0.83	6.99	15	41	10
	14	19	11	08.83	22	18	53.2	10.572 073	0.83	6.98	15	37	35
	15	19	11	30.49	22	18	21.3	10.585 600	0.83	6.97	15	34	01
	16	19	11	52.43	-22	17	48.7	10.598 971	0.83	6.96	15	30	27

SATURN, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	19	11	52.43	-22	17	48.7	10.598 971	0.83	6.96	15	30	27
	17	19	12	14.66	22	17	15.5	10.612 184	0.83	6.96	15	26	54
	18	19	12	37.16	22	16	41.6	10.625 235	0.83	6.95	15	23	20
	19	19	12	59.92	22	16	07.0	10.638 120	0.83	6.94	15	19	47
	20	19	13	22.95	22	15	31.7	10.650 838	0.83	6.93	15	16	14
	21	19	13	46.24	22	14	55.8	10.663 383	0.82	6.92	15	12	42
	22	19	14	09.79	-22	14	19.1	10.675 753	0.82	6.91	15	09	10
	23	19	14	33.58	22	13	41.8	10.687 945	0.82	6.91	15	05	37
	24	19	14	57.63	22	13	03.7	10.699 954	0.82	6.90	15	02	06
	25	19	15	21.93	22	12	24.9	10.711 777	0.82	6.89	14	58	34
	26	19	15	46.47	22	11	45.5	10.723 412	0.82	6.88	14	55	03
	27	19	16	11.25	22	11	05.3	10.734 854	0.82	6.88	14	51	32
	28	19	16	36.26	-22	10	24.5	10.746 101	0.82	6.87	14	48	01
	29	19	17	01.50	22	09	43.1	10.757 150	0.82	6.86	14	44	30
	30	19	17	26.95	22	09	00.9	10.767 998	0.82	6.86	14	40	60
Dec.	1	19	17	52.62	22	08	18.2	10.778 641	0.82	6.85	14	37	29
	2	19	18	18.50	22	07	34.7	10.789 079	0.82	6.84	14	33	59
	3	19	18	44.57	22	06	50.7	10.799 308	0.81	6.84	14	30	29
	4	19	19	10.84	-22	06	05.9	10.809 326	0.81	6.83	14	26	60
	5	19	19	37.31	22	05	20.5	10.819 131	0.81	6.82	14	23	30
	6	19	20	03.96	22	04	34.5	10.828 720	0.81	6.82	14	20	01
	7	19	20	30.79	22	03	47.7	10.838 092	0.81	6.81	14	16	32
	8	19	20	57.80	22	03	00.3	10.847 244	0.81	6.81	14	13	03
	9	19	21	24.99	22	02	12.3	10.856 175	0.81	6.80	14	09	34
	10	19	21	52.35	-22	01	23.6	10.864 883	0.81	6.79	14	06	06
	11	19	22	19.88	22	00	34.3	10.873 366	0.81	6.79	14	02	37
	12	19	22	47.56	21	59	44.3	10.881 622	0.81	6.78	13	59	09
	13	19	23	15.41	21	58	53.8	10.889 650	0.81	6.78	13	55	41
	14	19	23	43.41	21	58	02.6	10.897 448	0.81	6.77	13	52	13
	15	19	24	11.55	21	57	10.8	10.905 013	0.81	6.77	13	48	45
	16	19	24	39.83	-21	56	18.5	10.912 345	0.81	6.76	13	45	17
	17	19	25	08.25	21	55	25.5	10.919 441	0.81	6.76	13	41	50
	18	19	25	36.79	21	54	32.0	10.926 300	0.80	6.76	13	38	22
	19	19	26	05.46	21	53	37.9	10.932 919	0.80	6.75	13	34	55
	20	19	26	34.25	21	52	43.2	10.939 297	0.80	6.75	13	31	28
	21	19	27	03.15	21	51	47.9	10.945 431	0.80	6.74	13	28	01
	22	19	27	32.18	-21	50	51.9	10.951 320	0.80	6.74	13	24	34
	23	19	28	01.31	21	49	55.4	10.956 963	0.80	6.74	13	21	07
	24	19	28	30.55	21	48	58.4	10.962 356	0.80	6.73	13	17	40
	25	19	28	59.89	21	48	00.7	10.967 499	0.80	6.73	13	14	13
	26	19	29	29.33	21	47	02.6	10.972 391	0.80	6.73	13	10	47
	27	19	29	58.85	21	46	03.9	10.977 029	0.80	6.72	13	07	20
	28	19	30	28.46	-21	45	04.8	10.981 414	0.80	6.72	13	03	54
	29	19	30	58.13	21	44	05.1	10.985 543	0.80	6.72	13	00	27
	30	19	31	27.88	21	43	04.9	10.989 416	0.80	6.72	12	57	01
	31	19	31	57.68	21	42	04.3	10.993 032	0.80	6.72	12	53	35
	32	19	32	27.54	-21	41	03.1	10.996 391	0.80	6.71	12	50	09

URANUS, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ' "	° ' "			° ' "	° ' "	
Jan. 1	31 18 43.3	-0 31 28.0	19.862 04	Apr. 3	32 19 14.7	-0 30 51.9	19.851 36
3	31 20 02.2	0 31 27.2	19.861 81	5	32 20 33.6	0 30 51.1	19.851 12
5	31 21 21.1	0 31 26.4	19.861 58	7	32 21 52.7	0 30 50.3	19.850 89
7	31 22 40.0	0 31 25.6	19.861 35	9	32 23 11.7	0 30 49.5	19.850 65
9	31 23 58.9	0 31 24.9	19.861 12	11	32 24 30.6	0 30 48.7	19.850 42
11	31 25 17.8	0 31 24.1	19.860 89	13	32 25 49.6	0 30 47.9	19.850 18
13	31 26 36.7	-0 31 23.3	19.860 66	15	32 27 08.6	-0 30 47.1	19.849 95
15	31 27 55.6	0 31 22.5	19.860 43	17	32 28 27.7	0 30 46.4	19.849 71
17	31 29 14.5	0 31 21.7	19.860 20	19	32 29 46.7	0 30 45.6	19.849 48
19	31 30 33.4	0 31 21.0	19.859 96	21	32 31 05.7	0 30 44.8	19.849 25
21	31 31 52.4	0 31 20.2	19.859 73	23	32 32 24.7	0 30 44.0	19.849 01
23	31 33 11.3	0 31 19.4	19.859 50	25	32 33 43.7	0 30 43.2	19.848 78
25	31 34 30.2	-0 31 18.6	19.859 27	27	32 35 02.7	-0 30 42.4	19.848 54
27	31 35 49.1	0 31 17.9	19.859 04	29	32 36 21.7	0 30 41.6	19.848 31
29	31 37 08.0	0 31 17.1	19.858 81	May 1	32 37 40.8	0 30 40.8	19.848 07
31	31 38 27.0	0 31 16.3	19.858 58	3	32 38 59.8	0 30 40.0	19.847 83
Feb. 2	31 39 45.9	0 31 15.5	19.858 34	5	32 40 18.8	0 30 39.2	19.847 60
4	31 41 04.8	0 31 14.7	19.858 11	7	32 41 37.8	0 30 38.4	19.847 36
6	31 42 23.7	-0 31 14.0	19.857 88	9	32 42 56.9	-0 30 37.6	19.847 13
8	31 43 42.7	0 31 13.2	19.857 65	11	32 44 15.9	0 30 36.8	19.846 89
10	31 45 01.6	0 31 12.4	19.857 42	13	32 45 34.9	0 30 36.0	19.846 66
12	31 46 20.5	0 31 11.6	19.857 18	15	32 46 54.0	0 30 35.2	19.846 42
14	31 47 39.5	0 31 10.8	19.856 95	17	32 48 13.0	0 30 34.4	19.846 19
16	31 48 58.4	0 31 10.0	19.856 72	19	32 49 32.1	0 30 33.6	19.845 95
18	31 50 17.4	-0 31 09.2	19.856 49	21	32 50 51.1	-0 30 32.8	19.845 71
20	31 51 36.3	0 31 08.5	19.856 25	23	32 52 10.1	0 30 32.0	19.845 48
22	31 52 55.2	0 31 07.7	19.856 02	25	32 53 29.2	0 30 31.2	19.845 24
24	31 54 14.2	0 31 06.9	19.855 79	27	32 54 48.2	0 30 30.4	19.845 00
26	31 55 33.2	0 31 06.1	19.855 56	29	32 56 07.3	0 30 29.7	19.844 77
28	31 56 52.1	0 31 05.3	19.855 32	31	32 57 26.4	0 30 28.9	19.844 53
Mar. 2	31 58 11.1	-0 31 04.5	19.855 09	June 2	32 58 45.4	-0 30 28.0	19.844 29
4	31 59 30.0	0 31 03.7	19.854 86	4	33 00 04.5	0 30 27.2	19.844 06
6	32 00 49.0	0 31 03.0	19.854 63	6	33 01 23.5	0 30 26.4	19.843 82
8	32 02 07.9	0 31 02.2	19.854 39	8	33 02 42.6	0 30 25.6	19.843 58
10	32 03 26.9	0 31 01.4	19.854 16	10	33 04 01.7	0 30 24.8	19.843 35
12	32 04 45.9	0 31 00.6	19.853 93	12	33 05 20.7	0 30 24.0	19.843 11
14	32 06 04.9	-0 30 59.8	19.853 69	14	33 06 39.8	-0 30 23.2	19.842 87
16	32 07 23.8	0 30 59.0	19.853 46	16	33 07 58.9	0 30 22.4	19.842 64
18	32 08 42.8	0 30 58.2	19.853 23	18	33 09 18.0	0 30 21.6	19.842 40
20	32 10 01.8	0 30 57.4	19.852 99	20	33 10 37.0	0 30 20.8	19.842 16
22	32 11 20.7	0 30 56.7	19.852 76	22	33 11 56.1	0 30 20.0	19.841 92
24	32 12 39.7	0 30 55.9	19.852 52	24	33 13 15.2	0 30 19.2	19.841 69
26	32 13 58.7	-0 30 55.1	19.852 29	26	33 14 34.3	-0 30 18.4	19.841 45
28	32 15 17.7	0 30 54.3	19.852 06	28	33 15 53.4	0 30 17.6	19.841 21
30	32 16 36.7	0 30 53.5	19.851 82	30	33 17 12.4	0 30 16.8	19.840 97
Apr. 1	32 17 55.7	0 30 52.7	19.851 59	July 2	33 18 31.6	0 30 16.0	19.840 74
3	32 19 14.7	-0 30 51.9	19.851 36	4	33 19 50.6	-0 30 15.2	19.840 50

URANUS, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date		Heliocentric Longitude	Heliocentric Latitude	Radius Vector
		° ' "	° ' "				° ' "	° ' "	
July	2	33 18 31.6	-0 30 16.0	19.840 74	Oct.	2	34 19 12.2	-0 29 38.7	19.829 70
	4	33 19 50.6	0 30 15.2	19.840 50		4	34 20 31.3	0 29 37.9	19.829 46
	6	33 21 09.7	0 30 14.4	19.840 26		6	34 21 50.5	0 29 37.1	19.829 22
	8	33 22 28.8	0 30 13.6	19.840 02		8	34 23 09.8	0 29 36.3	19.828 97
	10	33 23 47.9	0 30 12.8	19.839 78		10	34 24 28.9	0 29 35.5	19.828 73
	12	33 25 07.0	0 30 12.0	19.839 54		12	34 25 48.1	0 29 34.6	19.828 49
	14	33 26 26.1	-0 30 11.2	19.839 31		14	34 27 07.4	-0 29 33.8	19.828 25
	16	33 27 45.3	0 30 10.4	19.839 07		16	34 28 26.6	0 29 33.0	19.828 01
	18	33 29 04.4	0 30 09.6	19.838 83		18	34 29 45.8	0 29 32.2	19.827 76
	20	33 30 23.4	0 30 08.8	19.838 59		20	34 31 05.0	0 29 31.3	19.827 52
	22	33 31 42.6	0 30 08.0	19.838 35		22	34 32 24.2	0 29 30.5	19.827 28
	24	33 33 01.7	0 30 07.1	19.838 11		24	34 33 43.4	0 29 29.7	19.827 04
	26	33 34 20.8	-0 30 06.3	19.837 87		26	34 35 02.7	-0 29 28.9	19.826 79
	28	33 35 39.9	0 30 05.5	19.837 64		28	34 36 21.9	0 29 28.1	19.826 55
	30	33 36 59.1	0 30 04.7	19.837 40		30	34 37 41.1	0 29 27.3	19.826 31
Aug.	1	33 38 18.2	0 30 03.9	19.837 16	Nov.	1	34 39 00.3	0 29 26.4	19.826 06
	3	33 39 37.3	0 30 03.1	19.836 92		3	34 40 19.6	0 29 25.6	19.825 82
	5	33 40 56.4	0 30 02.3	19.836 68		5	34 41 38.8	0 29 24.8	19.825 58
	7	33 42 15.6	-0 30 01.5	19.836 44		7	34 42 58.0	-0 29 24.0	19.825 33
	9	33 43 34.7	0 30 00.7	19.836 20		9	34 44 17.3	0 29 23.2	19.825 09
	11	33 44 53.8	0 29 59.9	19.835 96		11	34 45 36.5	0 29 22.3	19.824 85
	13	33 46 13.0	0 29 59.1	19.835 72		13	34 46 55.8	0 29 21.5	19.824 60
	15	33 47 32.1	0 29 58.2	19.835 48		15	34 48 15.0	0 29 20.7	19.824 36
	17	33 48 51.2	0 29 57.4	19.835 24		17	34 49 34.3	0 29 19.9	19.824 12
	19	33 50 10.4	-0 29 56.6	19.835 00		19	34 50 53.5	-0 29 19.0	19.823 87
	21	33 51 29.5	0 29 55.8	19.834 76		21	34 52 12.7	0 29 18.2	19.823 63
	23	33 52 48.7	0 29 55.0	19.834 52		23	34 53 32.0	0 29 17.4	19.823 38
	25	33 54 07.9	0 29 54.2	19.834 28		25	34 54 51.3	0 29 16.6	19.823 14
	27	33 55 27.0	0 29 53.4	19.834 04		27	34 56 10.5	0 29 15.7	19.822 90
	29	33 56 46.2	0 29 52.6	19.833 80		29	34 57 29.8	0 29 14.9	19.822 65
	31	33 58 05.3	-0 29 51.8	19.833 56	Dec.	1	34 58 49.1	-0 29 14.1	19.822 41
Sept.	2	33 59 24.5	0 29 51.0	19.833 32		3	35 00 08.3	0 29 13.2	19.822 16
	4	34 00 43.6	0 29 50.1	19.833 08		5	35 01 27.6	0 29 12.4	19.821 92
	6	34 02 02.8	0 29 49.3	19.832 84		7	35 02 46.9	0 29 11.6	19.821 67
	8	34 03 21.9	0 29 48.5	19.832 60		9	35 04 06.1	0 29 10.8	19.821 43
	10	34 04 41.1	0 29 47.7	19.832 36		11	35 05 25.4	0 29 10.0	19.821 18
	12	34 06 00.3	-0 29 46.9	19.832 11		13	35 06 44.7	-0 29 09.1	19.820 94
	14	34 07 19.5	0 29 46.1	19.831 87		15	35 08 04.0	0 29 08.3	19.820 70
	16	34 08 38.7	0 29 45.2	19.831 63		17	35 09 23.3	0 29 07.5	19.820 45
	18	34 09 57.8	0 29 44.4	19.831 39		19	35 10 42.6	0 29 06.7	19.820 20
	20	34 11 17.0	0 29 43.6	19.831 15		21	35 12 01.8	0 29 05.8	19.819 96
	22	34 12 36.2	0 29 42.8	19.830 91		23	35 13 21.1	0 29 05.0	19.819 71
	24	34 13 55.4	-0 29 42.0	19.830 67		25	35 14 40.4	-0 29 04.2	19.819 47
	26	34 15 14.6	0 29 41.2	19.830 43		27	35 15 59.7	0 29 03.3	19.819 22
	28	34 16 33.7	0 29 40.4	19.830 18		29	35 17 19.0	0 29 02.5	19.818 98
	30	34 17 52.9	0 29 39.6	19.829 94		31	35 18 38.3	0 29 01.7	19.818 73
Oct.	2	34 19 12.2	-0 29 38.7	19.829 70		33	35 19 57.6	-0 29 00.8	19.818 49

URANUS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"	Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Jan.	0	28	37	14.0	-0	32	02.2	Feb.	15	29	15	06.7	-0	30	31.4
	1	28	36	54.1	0	32	00.2		16	29	17	04.3	0	30	29.7
	2	28	36	37.2	0	31	58.2		17	29	19	04.5	0	30	27.9
	3	28	36	23.5	0	31	56.2		18	29	21	07.1	0	30	26.1
	4	28	36	13.0	0	31	54.2		19	29	23	12.2	0	30	24.4
	5	28	36	05.6	0	31	52.1		20	29	25	19.6	0	30	22.7
	6	28	36	01.4	-0	31	50.1		21	29	27	29.4	-0	30	21.0
	7	28	36	00.3	0	31	48.1		22	29	29	41.5	0	30	19.3
	8	28	36	02.3	0	31	46.1		23	29	31	56.0	0	30	17.6
	9	28	36	07.4	0	31	44.0		24	29	34	12.9	0	30	16.0
	10	28	36	15.7	0	31	42.0		25	29	36	32.1	0	30	14.3
	11	28	36	27.1	0	31	39.9		26	29	38	53.6	0	30	12.7
	12	28	36	41.7	-0	31	37.9		27	29	41	17.4	-0	30	11.1
	13	28	36	59.4	0	31	35.9		28	29	43	43.4	0	30	09.6
	14	28	37	20.2	0	31	33.8	Mar.	1	29	46	11.6	0	30	08.0
	15	28	37	44.2	0	31	31.8		2	29	48	41.9	0	30	06.5
	16	28	38	11.4	0	31	29.7		3	29	51	14.3	0	30	04.9
	17	28	38	41.7	0	31	27.7		4	29	53	48.8	0	30	03.4
	18	28	39	15.2	-0	31	25.6		5	29	56	25.2	-0	30	02.0
	19	28	39	51.9	0	31	23.6		6	29	59	03.6	0	30	00.5
	20	28	40	31.7	0	31	21.6		7	30	01	44.0	0	29	59.1
	21	28	41	14.6	0	31	19.5		8	30	04	26.2	0	29	57.6
	22	28	42	00.5	0	31	17.5		9	30	07	10.3	0	29	56.2
	23	28	42	49.4	0	31	15.5		10	30	09	56.3	0	29	54.8
	24	28	43	41.3	-0	31	13.5		11	30	12	44.1	-0	29	53.5
	25	28	44	36.2	0	31	11.5		12	30	15	33.6	0	29	52.1
	26	28	45	34.1	0	31	09.4		13	30	18	25.0	0	29	50.8
	27	28	46	35.0	0	31	07.5		14	30	21	18.0	0	29	49.5
	28	28	47	39.0	0	31	05.5		15	30	24	12.7	0	29	48.2
	29	28	48	46.1	0	31	03.5		16	30	27	09.0	0	29	46.9
	30	28	49	56.1	-0	31	01.5		17	30	30	06.8	-0	29	45.6
	31	28	51	09.2	0	30	59.6		18	30	33	06.2	0	29	44.4
Feb.	1	28	52	25.2	0	30	57.6		19	30	36	06.9	0	29	43.2
	2	28	53	44.2	0	30	55.7		20	30	39	08.9	0	29	42.0
	3	28	55	06.1	0	30	53.7		21	30	42	12.4	0	29	40.9
	4	28	56	30.8	0	30	51.8		22	30	45	17.1	0	29	39.7
	5	28	57	58.5	-0	30	49.9		23	30	48	23.2	-0	29	38.6
	6	28	59	28.9	0	30	48.0		24	30	51	30.6	0	29	37.5
	7	29	01	02.1	0	30	46.1		25	30	54	39.4	0	29	36.4
	8	29	02	38.1	0	30	44.2		26	30	57	49.3	0	29	35.4
	9	29	04	16.9	0	30	42.4		27	31	01	00.5	0	29	34.4
	10	29	05	58.4	0	30	40.5		28	31	04	12.8	0	29	33.3
	11	29	07	42.7	-0	30	38.7		29	31	07	26.1	-0	29	32.4
	12	29	09	29.7	0	30	36.9		30	31	10	40.5	0	29	31.4
	13	29	11	19.4	0	30	35.0		31	31	13	55.9	0	29	30.5
	14	29	13	11.7	0	30	33.2	Apr.	1	31	17	12.3	0	29	29.6
	15	29	15	06.7	-0	30	31.4		2	31	20	29.5	-0	29	28.7

URANUS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Apr.	1	31	17	12.3	-0	29	29.6	May	17	33	52	59.6	-0	29	11.9
	2	31	20	29.5	0	29	28.7		18	33	56	14.3	0	29	12.1
	3	31	23	47.5	0	29	27.8		19	33	59	28.1	0	29	12.2
	4	31	27	06.4	0	29	27.0		20	34	02	40.9	0	29	12.4
	5	31	30	26.1	0	29	26.1		21	34	05	52.6	0	29	12.6
	6	31	33	46.5	0	29	25.3		22	34	09	03.3	0	29	12.8
	7	31	37	07.7	-0	29	24.5		23	34	12	12.9	-0	29	13.1
	8	31	40	29.6	0	29	23.8		24	34	15	21.2	0	29	13.4
	9	31	43	52.1	0	29	23.0		25	34	18	28.4	0	29	13.7
	10	31	47	15.2	0	29	22.3		26	34	21	34.2	0	29	14.0
	11	31	50	39.0	0	29	21.6		27	34	24	38.8	0	29	14.3
	12	31	54	03.2	0	29	21.0		28	34	27	42.0	0	29	14.6
	13	31	57	27.8	-0	29	20.3		29	34	30	43.8	-0	29	15.0
	14	32	00	52.8	0	29	19.7		30	34	33	44.3	0	29	15.4
	15	32	04	18.2	0	29	19.1		31	34	36	43.3	0	29	15.8
	16	32	07	43.7	0	29	18.5	June	1	34	39	40.9	0	29	16.2
	17	32	11	09.6	0	29	18.0		2	34	42	37.1	0	29	16.7
	18	32	14	35.6	0	29	17.4		3	34	45	31.8	0	29	17.1
	19	32	18	01.8	-0	29	16.9		4	34	48	24.9	-0	29	17.6
	20	32	21	28.3	0	29	16.5		5	34	51	16.5	0	29	18.1
	21	32	24	55.0	0	29	16.0		6	34	54	06.4	0	29	18.6
	22	32	28	21.9	0	29	15.7		7	34	56	54.6	0	29	19.1
	23	32	31	48.2	0	29	16.0		8	34	59	41.0	0	29	19.7
	24	32	35	14.8	0	29	14.9		9	35	02	25.6	0	29	20.2
	25	32	38	41.8	-0	29	14.4		10	35	05	08.4	-0	29	20.8
	26	32	42	08.6	0	29	14.1		11	35	07	49.3	0	29	21.4
	27	32	45	35.2	0	29	13.7		12	35	10	28.3	0	29	22.0
	28	32	49	01.7	0	29	13.4		13	35	13	05.5	0	29	22.7
	29	32	52	27.9	0	29	13.2		14	35	15	40.9	0	29	23.3
	30	32	55	53.8	0	29	12.9		15	35	18	14.3	0	29	24.0
May	1	32	59	19.5	-0	29	12.7		16	35	20	45.8	-0	29	24.7
	2	33	02	44.8	0	29	12.5		17	35	23	15.4	0	29	25.4
	3	33	06	09.8	0	29	12.3		18	35	25	43.0	0	29	26.1
	4	33	09	34.4	0	29	12.1		19	35	28	08.5	0	29	26.9
	5	33	12	58.6	0	29	12.0		20	35	30	31.9	0	29	27.6
	6	33	16	22.3	0	29	11.8		21	35	32	53.2	0	29	28.4
	7	33	19	45.6	-0	29	11.7		22	35	35	12.3	-0	29	29.2
	8	33	23	08.3	0	29	11.7		23	35	37	29.3	0	29	30.0
	9	33	26	30.4	0	29	11.6		24	35	39	44.0	0	29	30.8
	10	33	29	51.9	0	29	11.6		25	35	41	56.5	0	29	31.6
	11	33	33	12.7	0	29	11.5		26	35	44	06.7	0	29	32.5
	12	33	36	32.7	0	29	11.5		27	35	46	14.6	0	29	33.3
	13	33	39	51.8	-0	29	11.6		28	35	48	20.2	-0	29	34.2
	14	33	43	10.1	0	29	11.6		29	35	50	23.6	0	29	35.1
	15	33	46	27.5	0	29	11.7		30	35	52	24.6	0	29	36.0
	16	33	49	44.0	0	29	11.8	July	1	35	54	23.3	0	29	36.9
	17	33	52	59.6	-0	29	11.9		2	35	56	19.6	-0	29	37.8

URANUS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	35	54	23.3	-0	29	36.9	Aug.	16	36	36	32.3	-0	30	26.1
	2	35	56	19.6	0	29	37.8		17	36	36	19.2	0	30	27.2
	3	35	58	13.4	0	29	38.7		18	36	36	03.2	0	30	28.2
	4	36	00	04.8	0	29	39.6		19	36	35	44.2	0	30	29.3
	5	36	01	53.6	0	29	40.6		20	36	35	22.4	0	30	30.4
	6	36	03	39.8	0	29	41.5		21	36	34	57.6	0	30	31.5
	7	36	05	23.4	-0	29	42.5		22	36	34	29.9	-0	30	32.5
	8	36	07	04.4	0	29	43.5		23	36	33	59.4	0	30	33.5
	9	36	08	42.7	0	29	44.5		24	36	33	26.1	0	30	34.6
	10	36	10	18.5	0	29	45.5		25	36	32	49.9	0	30	35.6
	11	36	11	51.6	0	29	46.5		26	36	32	10.9	0	30	36.6
	12	36	13	22.2	0	29	47.5		27	36	31	29.1	0	30	37.6
	13	36	14	50.1	-0	29	48.5		28	36	30	44.4	-0	30	38.6
	14	36	16	15.4	0	29	49.6		29	36	29	56.8	0	30	39.6
	15	36	17	38.0	0	29	50.6		30	36	29	06.4	0	30	40.5
	16	36	18	57.9	0	29	51.7		31	36	28	13.1	0	30	41.5
	17	36	20	15.1	0	29	52.8	Sept.	1	36	27	17.0	0	30	42.4
	18	36	21	29.5	0	29	53.8		2	36	26	18.1	0	30	43.4
	19	36	22	41.1	-0	29	54.9		3	36	25	16.6	-0	30	44.3
	20	36	23	49.9	0	29	56.0		4	36	24	12.4	0	30	45.2
	21	36	24	55.8	0	29	57.1		5	36	23	05.6	0	30	46.1
	22	36	25	59.0	0	29	58.2		6	36	21	56.3	0	30	47.0
	23	36	26	59.3	0	29	59.3		7	36	20	44.3	0	30	47.8
	24	36	27	56.7	0	30	00.4		8	36	19	29.8	0	30	48.7
	25	36	28	51.3	-0	30	01.5		9	36	18	12.8	-0	30	49.5
	26	36	29	43.1	0	30	02.6		10	36	16	53.2	0	30	50.3
	27	36	30	32.0	0	30	03.7		11	36	15	31.1	0	30	51.1
	28	36	31	18.1	0	30	04.8		12	36	14	06.6	0	30	51.9
	29	36	32	01.3	0	30	05.9		13	36	12	39.6	0	30	52.7
	30	36	32	41.6	0	30	07.0		14	36	11	10.1	0	30	53.4
	31	36	33	19.0	-0	30	08.2		15	36	09	38.4	-0	30	54.1
Aug.	1	36	33	53.4	0	30	09.3		16	36	08	04.3	0	30	54.8
	2	36	34	24.8	0	30	10.4		17	36	06	27.9	0	30	55.5
	3	36	34	53.1	0	30	11.5		18	36	04	49.3	0	30	56.1
	4	36	35	18.4	0	30	12.6		19	36	03	08.5	0	30	56.8
	5	36	35	40.8	0	30	13.8		20	36	01	25.6	0	30	57.4
	6	36	36	00.1	-0	30	14.9		21	35	59	40.6	-0	30	58.0
	7	36	36	16.6	0	30	16.0		22	35	57	53.5	0	30	58.5
	8	36	36	30.1	0	30	17.1		23	35	56	04.4	0	30	59.1
	9	36	36	40.7	0	30	18.3		24	35	54	13.3	0	30	59.6
	10	36	36	48.3	0	30	19.4		25	35	52	20.2	0	31	00.1
	11	36	36	53.1	0	30	20.5		26	35	50	25.1	0	31	00.6
	12	36	36	54.8	-0	30	21.6		27	35	48	28.0	-0	31	01.0
	13	36	36	53.7	0	30	22.8		28	35	46	29.0	0	31	01.4
	14	36	36	49.5	0	30	23.9		29	35	44	28.3	0	31	01.8
	15	36	36	42.4	0	30	25.0		30	35	42	25.8	0	31	02.2
	16	36	36	32.3	-0	30	26.1	Oct.	1	35	40	21.6	-0	31	02.6

URANUS, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
Oct.	1	35	40	21.6	-0	31	02.6	Nov.	16	33	51	41.6	-0	30	47.5
	2	35	38	15.9	0	31	02.9		17	33	49	25.5	0	30	46.5
	3	35	36	08.7	0	31	03.2		18	33	47	10.7	0	30	45.5
	4	35	34	00.0	0	31	03.5		19	33	44	57.1	0	30	44.4
	5	35	31	49.9	0	31	03.7		20	33	42	44.7	0	30	43.3
	6	35	29	38.3	0	31	03.9		21	33	40	33.8	0	30	42.1
	7	35	27	25.4	-0	31	04.1		22	33	38	24.2	-0	30	41.0
	8	35	25	11.2	0	31	04.3		23	33	36	16.2	0	30	39.8
	9	35	22	55.7	0	31	04.5		24	33	34	09.7	0	30	38.6
	10	35	20	39.0	0	31	04.6		25	33	32	04.9	0	30	37.3
	11	35	18	21.1	0	31	04.6		26	33	30	01.9	0	30	36.1
	12	35	16	02.2	0	31	04.7		27	33	28	00.7	0	30	34.8
	13	35	13	42.2	-0	31	04.7		28	33	26	01.4	-0	30	33.5
	14	35	11	21.3	0	31	04.7		29	33	24	03.9	0	30	32.1
	15	35	08	59.5	0	31	04.7		30	33	22	08.4	0	30	30.8
	16	35	06	36.9	0	31	04.6	Dec.	1	33	20	14.8	0	30	29.4
	17	35	04	13.5	0	31	04.5		2	33	18	23.2	0	30	28.0
	18	35	01	49.5	0	31	04.4		3	33	16	33.6	0	30	26.6
	19	34	59	24.9	-0	31	04.2		4	33	14	46.1	-0	30	25.1
	20	34	56	59.6	0	31	04.0		5	33	13	00.8	0	30	23.7
	21	34	54	33.8	0	31	03.8		6	33	11	17.7	0	30	22.2
	22	34	52	07.5	0	31	03.5		7	33	09	36.8	0	30	20.7
	23	34	49	40.8	0	31	03.3		8	33	07	58.3	0	30	19.1
	24	34	47	13.6	0	31	02.9		9	33	06	22.1	0	30	17.6
	25	34	44	46.1	-0	31	02.6		10	33	04	48.3	-0	30	16.0
	26	34	42	18.3	0	31	02.2		11	33	03	17.0	0	30	14.4
	27	34	39	50.3	0	31	01.8		12	33	01	48.2	0	30	12.8
	28	34	37	22.3	0	31	01.4		13	33	00	21.9	0	30	11.1
	29	34	34	54.3	0	31	01.0		14	32	58	58.1	0	30	09.5
	30	34	32	26.3	0	31	00.5		15	32	57	37.0	0	30	07.8
	31	34	29	58.6	-0	30	59.9		16	32	56	18.3	-0	30	06.1
Nov.	1	34	27	31.0	0	30	59.4		17	32	55	02.3	0	30	04.4
	2	34	25	03.7	0	30	58.8		18	32	53	48.8	0	30	02.7
	3	34	22	36.7	0	30	58.2		19	32	52	38.0	0	30	00.9
	4	34	20	10.1	0	30	57.6		20	32	51	29.9	0	29	59.2
	5	34	17	43.8	0	30	56.9		21	32	50	24.6	0	29	57.4
	6	34	15	18.1	-0	30	56.2		22	32	49	22.2	-0	29	55.7
	7	34	12	52.8	0	30	55.5		23	32	48	22.6	0	29	53.9
	8	34	10	28.2	0	30	54.7		24	32	47	25.9	0	29	52.1
	9	34	08	04.2	0	30	53.9		25	32	46	32.1	0	29	50.3
	10	34	05	41.0	0	30	53.1		26	32	45	41.4	0	29	48.5
	11	34	03	18.6	0	30	52.3		27	32	44	53.5	0	29	46.6
	12	34	00	57.2	-0	30	51.4		28	32	44	08.6	-0	29	44.8
	13	33	58	36.7	0	30	50.5		29	32	43	26.7	0	29	43.0
	14	33	56	17.2	0	30	49.5		30	32	42	47.7	0	29	41.1
	15	33	53	58.8	0	30	48.5		31	32	42	11.7	0	29	39.2
	16	33	51	41.6	-0	30	47.5		32	32	41	38.8	-0	29	37.4

URANUS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	1	47	09.32	+10	29	00.2	19.514 236	0.45	1.79	19	06	31
	1	1	47	08.00	10	28	55.0	19.530 502	0.45	1.79	19	02	34
	2	1	47	06.89	10	28	50.9	19.546 864	0.45	1.79	18	58	37
	3	1	47	05.97	10	28	47.9	19.563 319	0.45	1.79	18	54	40
	4	1	47	05.26	10	28	46.0	19.579 860	0.45	1.79	18	50	44
	5	1	47	04.74	10	28	45.3	19.596 482	0.45	1.79	18	46	48
	6	1	47	04.42	+10	28	45.7	19.613 179	0.45	1.79	18	42	51
	7	1	47	04.30	10	28	47.2	19.629 946	0.45	1.78	18	38	56
	8	1	47	04.38	10	28	49.8	19.646 777	0.45	1.78	18	34	60
	9	1	47	04.66	10	28	53.6	19.663 667	0.45	1.78	18	31	04
	10	1	47	05.13	10	28	58.5	19.680 609	0.45	1.78	18	27	09
	11	1	47	05.81	10	29	04.4	19.697 598	0.45	1.78	18	23	14
	12	1	47	06.68	+10	29	11.5	19.714 630	0.45	1.78	18	19	19
	13	1	47	07.75	10	29	19.7	19.731 697	0.45	1.77	18	15	24
	14	1	47	09.02	10	29	29.0	19.748 795	0.45	1.77	18	11	30
	15	1	47	10.49	10	29	39.5	19.765 918	0.44	1.77	18	07	36
	16	1	47	12.17	10	29	51.0	19.783 061	0.44	1.77	18	03	42
	17	1	47	14.04	10	30	03.7	19.800 219	0.44	1.77	17	59	48
	18	1	47	16.12	+10	30	17.5	19.817 386	0.44	1.77	17	55	54
	19	1	47	18.39	10	30	32.4	19.834 557	0.44	1.77	17	52	00
	20	1	47	20.87	10	30	48.5	19.851 727	0.44	1.76	17	48	07
	21	1	47	23.54	10	31	05.6	19.868 892	0.44	1.76	17	44	14
	22	1	47	26.40	10	31	23.8	19.886 047	0.44	1.76	17	40	21
	23	1	47	29.45	10	31	43.1	19.903 187	0.44	1.76	17	36	28
	24	1	47	32.69	+10	32	03.4	19.920 307	0.44	1.76	17	32	36
	25	1	47	36.12	10	32	24.8	19.937 402	0.44	1.76	17	28	43
	26	1	47	39.74	10	32	47.2	19.954 468	0.44	1.75	17	24	51
	27	1	47	43.56	10	33	10.7	19.971 500	0.44	1.75	17	20	59
	28	1	47	47.57	10	33	35.2	19.988 492	0.44	1.75	17	17	08
	29	1	47	51.77	10	34	00.9	20.005 439	0.44	1.75	17	13	16
	30	1	47	56.16	+10	34	27.5	20.022 337	0.44	1.75	17	09	25
	31	1	48	00.75	10	34	55.2	20.039 180	0.44	1.75	17	05	33
Feb.	1	1	48	05.53	10	35	24.0	20.055 962	0.44	1.75	17	01	42
	2	1	48	10.49	10	35	53.8	20.072 680	0.44	1.74	16	57	51
	3	1	48	15.63	10	36	24.6	20.089 326	0.44	1.74	16	54	01
	4	1	48	20.96	10	36	56.5	20.105 897	0.44	1.74	16	50	10
	5	1	48	26.48	+10	37	29.3	20.122 386	0.44	1.74	16	46	20
	6	1	48	32.17	10	38	03.1	20.138 790	0.44	1.74	16	42	30
	7	1	48	38.03	10	38	37.9	20.155 103	0.44	1.74	16	38	40
	8	1	48	44.08	10	39	13.7	20.171 319	0.44	1.74	16	34	50
	9	1	48	50.30	10	39	50.4	20.187 435	0.44	1.73	16	31	01
	10	1	48	56.70	10	40	28.0	20.203 446	0.44	1.73	16	27	11
	11	1	49	03.27	+10	41	06.6	20.219 346	0.43	1.73	16	23	22
	12	1	49	10.02	10	41	46.1	20.235 131	0.43	1.73	16	19	33
	13	1	49	16.93	10	42	26.6	20.250 796	0.43	1.73	16	15	44
	14	1	49	24.02	10	43	08.0	20.266 339	0.43	1.73	16	11	55
	15	1	49	31.28	+10	43	50.3	20.281 753	0.43	1.73	16	08	07

URANUS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	1	49	31.28	+10	43	50.3	20.281 753	0.43	1.73	16	08	07
	16	1	49	38.70	10	44	33.5	20.297 035	0.43	1.73	16	04	18
	17	1	49	46.29	10	45	17.6	20.312 182	0.43	1.72	16	00	30
	18	1	49	54.03	10	46	02.5	20.327 189	0.43	1.72	15	56	42
	19	1	50	01.93	10	46	48.3	20.342 053	0.43	1.72	15	52	54
	20	1	50	09.98	10	47	34.9	20.356 770	0.43	1.72	15	49	06
	21	1	50	18.18	+10	48	22.3	20.371 336	0.43	1.72	15	45	18
	22	1	50	26.53	10	49	10.4	20.385 749	0.43	1.72	15	41	31
	23	1	50	35.04	10	49	59.4	20.400 003	0.43	1.72	15	37	44
	24	1	50	43.69	10	50	49.2	20.414 096	0.43	1.72	15	33	56
	25	1	50	52.50	10	51	39.7	20.428 024	0.43	1.71	15	30	09
	26	1	51	01.45	10	52	31.0	20.441 783	0.43	1.71	15	26	22
	27	1	51	10.55	+10	53	23.1	20.455 368	0.43	1.71	15	22	36
	28	1	51	19.79	10	54	15.9	20.468 777	0.43	1.71	15	18	49
Mar.	1	1	51	29.17	10	55	09.5	20.482 004	0.43	1.71	15	15	02
	2	1	51	38.69	10	56	03.8	20.495 047	0.43	1.71	15	11	16
	3	1	51	48.34	10	56	58.8	20.507 902	0.43	1.71	15	07	30
	4	1	51	58.12	10	57	54.5	20.520 565	0.43	1.71	15	03	44
	5	1	52	08.03	+10	58	50.8	20.533 032	0.43	1.71	14	59	58
	6	1	52	18.07	10	59	47.8	20.545 300	0.43	1.70	14	56	12
	7	1	52	28.23	11	00	45.4	20.557 366	0.43	1.70	14	52	26
	8	1	52	38.52	11	01	43.7	20.569 225	0.43	1.70	14	48	41
	9	1	52	48.92	11	02	42.5	20.580 876	0.43	1.70	14	44	55
	10	1	52	59.45	11	03	42.0	20.592 315	0.43	1.70	14	41	10
	11	1	53	10.09	+11	04	42.0	20.603 538	0.43	1.70	14	37	25
	12	1	53	20.85	11	05	42.7	20.614 544	0.43	1.70	14	33	39
	13	1	53	31.72	11	06	43.9	20.625 329	0.43	1.70	14	29	54
	14	1	53	42.70	11	07	45.6	20.635 890	0.43	1.70	14	26	10
	15	1	53	53.79	11	08	47.9	20.646 226	0.43	1.70	14	22	25
	16	1	54	04.98	11	09	50.7	20.656 334	0.43	1.70	14	18	40
	17	1	54	16.28	+11	10	54.1	20.666 212	0.43	1.69	14	14	55
	18	1	54	27.66	11	11	57.9	20.675 859	0.43	1.69	14	11	11
	19	1	54	39.14	11	13	02.1	20.685 271	0.43	1.69	14	07	26
	20	1	54	50.71	11	14	06.8	20.694 447	0.42	1.69	14	03	42
	21	1	55	02.37	11	15	11.8	20.703 386	0.42	1.69	13	59	58
	22	1	55	14.11	11	16	17.3	20.712 086	0.42	1.69	13	56	14
	23	1	55	25.94	+11	17	23.2	20.720 544	0.42	1.69	13	52	30
	24	1	55	37.86	11	18	29.5	20.728 759	0.42	1.69	13	48	46
	25	1	55	49.86	11	19	36.2	20.736 729	0.42	1.69	13	45	02
	26	1	56	01.95	11	20	43.2	20.744 452	0.42	1.69	13	41	18
	27	1	56	14.11	11	21	50.6	20.751 925	0.42	1.69	13	37	34
	28	1	56	26.35	11	22	58.4	20.759 147	0.42	1.69	13	33	50
	29	1	56	38.66	+11	24	06.5	20.766 116	0.42	1.69	13	30	07
	30	1	56	51.03	11	25	14.9	20.772 829	0.42	1.69	13	26	23
	31	1	57	03.47	11	26	23.6	20.779 286	0.42	1.69	13	22	40
Apr.	1	1	57	15.97	11	27	32.6	20.785 483	0.42	1.68	13	18	56
	2	1	57	28.54	+11	28	41.8	20.791 421	0.42	1.68	13	15	13

URANUS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	1	57	15.97	+11	27	32.6	20.785 483	0.42	1.68	13	18	56
	2	1	57	28.54	11	28	41.8	20.791 421	0.42	1.68	13	15	13
	3	1	57	41.15	11	29	51.3	20.797 096	0.42	1.68	13	11	29
	4	1	57	53.83	11	31	01.0	20.802 508	0.42	1.68	13	07	46
	5	1	58	06.55	11	32	10.9	20.807 656	0.42	1.68	13	04	03
	6	1	58	19.33	11	33	20.9	20.812 537	0.42	1.68	13	00	20
	7	1	58	32.16	+11	34	31.2	20.817 151	0.42	1.68	12	56	37
	8	1	58	45.03	11	35	41.7	20.821 497	0.42	1.68	12	52	54
	9	1	58	57.95	11	36	52.3	20.825 574	0.42	1.68	12	49	11
	10	1	59	10.91	11	38	03.1	20.829 382	0.42	1.68	12	45	28
	11	1	59	23.90	11	39	14.0	20.832 919	0.42	1.68	12	41	45
	12	1	59	36.94	11	40	25.1	20.836 185	0.42	1.68	12	38	02
	13	1	59	50.00	+11	41	36.2	20.839 180	0.42	1.68	12	34	19
	14	2	00	03.09	11	42	47.5	20.841 905	0.42	1.68	12	30	36
	15	2	00	16.20	11	43	58.7	20.844 358	0.42	1.68	12	26	53
	16	2	00	29.33	11	45	10.0	20.846 540	0.42	1.68	12	23	10
	17	2	00	42.47	11	46	21.4	20.848 451	0.42	1.68	12	19	27
	18	2	00	55.64	11	47	32.7	20.850 091	0.42	1.68	12	15	45
	19	2	01	08.82	+11	48	44.0	20.851 460	0.42	1.68	12	12	02
	20	2	01	22.01	11	49	55.3	20.852 559	0.42	1.68	12	08	19
	21	2	01	35.23	11	51	06.6	20.853 386	0.42	1.68	12	04	36
	22	2	01	48.46	11	52	17.8	20.853 942	0.42	1.68	12	00	54
	23	2	02	01.67	11	53	28.2	20.854 226	0.42	1.68	11	57	11
	24	2	02	14.87	11	54	40.0	20.854 239	0.42	1.68	11	53	28
	25	2	02	28.11	+11	55	51.3	20.853 981	0.42	1.68	11	49	45
	26	2	02	41.34	11	57	02.4	20.853 451	0.42	1.68	11	46	02
	27	2	02	54.56	11	58	13.4	20.852 649	0.42	1.68	11	42	20
	28	2	03	07.78	11	59	24.3	20.851 576	0.42	1.68	11	38	37
	29	2	03	20.98	12	00	35.0	20.850 231	0.42	1.68	11	34	54
	30	2	03	34.17	12	01	45.6	20.848 616	0.42	1.68	11	31	11
May	1	2	03	47.34	+12	02	56.0	20.846 729	0.42	1.68	11	27	29
	2	2	04	00.49	12	04	06.2	20.844 572	0.42	1.68	11	23	46
	3	2	04	13.63	12	05	16.2	20.842 145	0.42	1.68	11	20	03
	4	2	04	26.74	12	06	26.0	20.839 449	0.42	1.68	11	16	20
	5	2	04	39.82	12	07	35.6	20.836 484	0.42	1.68	11	12	37
	6	2	04	52.89	12	08	45.0	20.833 252	0.42	1.68	11	08	54
	7	2	05	05.92	+12	09	54.2	20.829 753	0.42	1.68	11	05	11
	8	2	05	18.92	12	11	03.2	20.825 989	0.42	1.68	11	01	28
	9	2	05	31.89	12	12	11.9	20.821 961	0.42	1.68	10	57	45
	10	2	05	44.81	12	13	20.3	20.817 670	0.42	1.68	10	54	02
	11	2	05	57.69	12	14	28.4	20.813 118	0.42	1.68	10	50	19
	12	2	06	10.53	12	15	36.2	20.808 307	0.42	1.68	10	46	36
	13	2	06	23.31	+12	16	43.7	20.803 238	0.42	1.68	10	42	53
	14	2	06	36.04	12	17	50.8	20.797 914	0.42	1.68	10	39	09
	15	2	06	48.71	12	18	57.6	20.792 335	0.42	1.68	10	35	26
	16	2	07	01.34	12	20	04.0	20.786 504	0.42	1.68	10	31	43
	17	2	07	13.90	+12	21	10.0	20.780 423	0.42	1.69	10	27	59

URANUS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	2	07	13.90	+12	21	10.0	20.780 423	0.42	1.69	10	27	59
	18	2	07	26.41	12	22	15.6	20.774 093	0.42	1.69	10	24	16
	19	2	07	38.86	12	23	20.8	20.767 515	0.42	1.69	10	20	32
	20	2	07	51.26	12	24	25.7	20.760 692	0.42	1.69	10	16	49
	21	2	08	03.58	12	25	30.2	20.753 625	0.42	1.69	10	13	05
	22	2	08	15.84	12	26	34.2	20.746 315	0.42	1.69	10	09	21
	23	2	08	28.03	+12	27	37.9	20.738 764	0.42	1.69	10	05	37
	24	2	08	40.15	12	28	41.1	20.730 974	0.42	1.69	10	01	53
	25	2	08	52.19	12	29	43.8	20.722 946	0.42	1.69	9	58	09
	26	2	09	04.15	12	30	46.0	20.714 682	0.42	1.69	9	54	25
	27	2	09	16.02	12	31	47.8	20.706 184	0.42	1.69	9	50	41
	28	2	09	27.81	12	32	49.0	20.697 453	0.42	1.69	9	46	57
	29	2	09	39.52	+12	33	49.8	20.688 493	0.43	1.69	9	43	13
	30	2	09	51.14	12	34	50.0	20.679 304	0.43	1.69	9	39	28
	31	2	10	02.67	12	35	49.6	20.669 890	0.43	1.69	9	35	44
June	1	2	10	14.11	12	36	48.8	20.660 251	0.43	1.70	9	31	59
	2	2	10	25.46	12	37	47.4	20.650 392	0.43	1.70	9	28	15
	3	2	10	36.72	12	38	45.4	20.640 314	0.43	1.70	9	24	30
	4	2	10	47.87	+12	39	42.9	20.630 019	0.43	1.70	9	20	45
	5	2	10	58.93	12	40	39.8	20.619 512	0.43	1.70	9	17	00
	6	2	11	09.88	12	41	36.2	20.608 794	0.43	1.70	9	13	15
	7	2	11	20.73	12	42	31.9	20.597 869	0.43	1.70	9	09	30
	8	2	11	31.46	12	43	27.0	20.586 740	0.43	1.70	9	05	45
	9	2	11	42.08	12	44	21.5	20.575 410	0.43	1.70	9	01	59
	10	2	11	52.58	+12	45	15.3	20.563 883	0.43	1.70	8	58	14
	11	2	12	02.96	12	46	08.4	20.552 161	0.43	1.70	8	54	28
	12	2	12	13.22	12	47	00.9	20.540 248	0.43	1.70	8	50	42
	13	2	12	23.37	12	47	52.6	20.528 148	0.43	1.71	8	46	56
	14	2	12	33.40	12	48	43.8	20.515 862	0.43	1.71	8	43	10
	15	2	12	43.31	12	49	34.2	20.503 395	0.43	1.71	8	39	24
	16	2	12	53.09	+12	50	23.9	20.490 749	0.43	1.71	8	35	38
	17	2	13	02.75	12	51	13.0	20.477 928	0.43	1.71	8	31	52
	18	2	13	12.29	12	52	01.4	20.464 934	0.43	1.71	8	28	05
	19	2	13	21.69	12	52	49.0	20.451 770	0.43	1.71	8	24	19
	20	2	13	30.96	12	53	36.0	20.438 439	0.43	1.71	8	20	32
	21	2	13	40.09	12	54	22.2	20.424 944	0.43	1.71	8	16	45
	22	2	13	49.08	+12	55	07.7	20.411 289	0.43	1.72	8	12	58
	23	2	13	57.94	12	55	52.4	20.397 477	0.43	1.72	8	09	11
	24	2	14	06.65	12	56	36.3	20.383 510	0.43	1.72	8	05	24
	25	2	14	15.21	12	57	19.4	20.369 392	0.43	1.72	8	01	36
	26	2	14	23.64	12	58	01.8	20.355 126	0.43	1.72	7	57	49
	27	2	14	31.91	12	58	43.3	20.340 716	0.43	1.72	7	54	01
	28	2	14	40.04	+12	59	24.1	20.326 165	0.43	1.72	7	50	13
	29	2	14	48.03	13	00	04.1	20.311 478	0.43	1.72	7	46	25
	30	2	14	55.86	13	00	43.3	20.296 657	0.43	1.73	7	42	37
July	1	2	15	03.55	13	01	21.7	20.281 706	0.43	1.73	7	38	49
	2	2	15	11.08	+13	01	59.2	20.266 630	0.43	1.73	7	35	00

URANUS, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	2	15	03.55	+13	01	21.7	20.281 706	0.43	1.73	7	38	49
	2	2	15	11.08	13	01	59.2	20.266 630	0.43	1.73	7	35	00
	3	2	15	18.45	13	02	36.0	20.251 433	0.43	1.73	7	31	11
	4	2	15	25.66	13	03	11.9	20.236 118	0.43	1.73	7	27	23
	5	2	15	32.71	13	03	47.0	20.220 691	0.43	1.73	7	23	34
	6	2	15	39.59	13	04	21.2	20.205 155	0.44	1.73	7	19	45
	7	2	15	46.31	+13	04	54.5	20.189 516	0.44	1.73	7	15	55
	8	2	15	52.85	13	05	26.9	20.173 777	0.44	1.74	7	12	06
	9	2	15	59.23	13	05	58.4	20.157 943	0.44	1.74	7	08	16
	10	2	16	05.44	13	06	29.1	20.142 018	0.44	1.74	7	04	26
	11	2	16	11.48	13	06	58.8	20.126 006	0.44	1.74	7	00	36
	12	2	16	17.36	13	07	27.6	20.109 912	0.44	1.74	6	56	46
	13	2	16	23.07	+13	07	55.6	20.093 740	0.44	1.74	6	52	56
	14	2	16	28.60	13	08	22.7	20.077 494	0.44	1.74	6	49	06
	15	2	16	33.97	13	08	48.9	20.061 178	0.44	1.75	6	45	15
	16	2	16	39.16	13	09	14.2	20.044 795	0.44	1.75	6	41	24
	17	2	16	44.17	13	09	38.6	20.028 350	0.44	1.75	6	37	33
	18	2	16	49.00	13	10	02.1	20.011 847	0.44	1.75	6	33	42
	19	2	16	53.66	+13	10	24.7	19.995 290	0.44	1.75	6	29	51
	20	2	16	58.13	13	10	46.3	19.978 682	0.44	1.75	6	25	59
	21	2	17	02.42	13	11	07.0	19.962 029	0.44	1.75	6	22	08
	22	2	17	06.52	13	11	26.7	19.945 334	0.44	1.76	6	18	16
	23	2	17	10.44	13	11	45.5	19.928 602	0.44	1.76	6	14	24
	24	2	17	14.18	13	12	03.4	19.911 836	0.44	1.76	6	10	31
	25	2	17	17.74	+13	12	20.3	19.895 042	0.44	1.76	6	06	39
	26	2	17	21.11	13	12	36.2	19.878 223	0.44	1.76	6	02	46
	27	2	17	24.30	13	12	51.2	19.861 384	0.44	1.76	5	58	54
	28	2	17	27.31	13	13	05.3	19.844 531	0.44	1.76	5	55	01
	29	2	17	30.13	13	13	18.4	19.827 666	0.44	1.77	5	51	07
	30	2	17	32.76	13	13	30.6	19.810 796	0.44	1.77	5	47	14
	31	2	17	35.20	+13	13	41.8	19.793 925	0.44	1.77	5	43	21
Aug.	1	2	17	37.45	13	13	52.1	19.777 059	0.44	1.77	5	39	27
	2	2	17	39.51	13	14	01.4	19.760 202	0.45	1.77	5	35	33
	3	2	17	41.37	13	14	09.7	19.743 359	0.45	1.77	5	31	39
	4	2	17	43.03	13	14	17.0	19.726 536	0.45	1.78	5	27	45
	5	2	17	44.50	13	14	23.3	19.709 738	0.45	1.78	5	23	50
	6	2	17	45.78	+13	14	28.6	19.692 969	0.45	1.78	5	19	55
	7	2	17	46.87	13	14	32.9	19.676 236	0.45	1.78	5	16	01
	8	2	17	47.76	13	14	36.2	19.659 541	0.45	1.78	5	12	05
	9	2	17	48.48	13	14	38.6	19.642 890	0.45	1.78	5	08	10
	10	2	17	49.00	13	14	40.1	19.626 288	0.45	1.78	5	04	15
	11	2	17	49.33	13	14	40.6	19.609 739	0.45	1.79	5	00	19
	12	2	17	49.47	+13	14	40.1	19.593 247	0.45	1.79	4	56	23
	13	2	17	49.42	13	14	38.7	19.576 817	0.45	1.79	4	52	27
	14	2	17	49.17	13	14	36.3	19.560 454	0.45	1.79	4	48	31
	15	2	17	48.73	13	14	33.0	19.544 161	0.45	1.79	4	44	35
	16	2	17	48.11	+13	14	28.6	19.527 943	0.45	1.79	4	40	38

URANUS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	2	17	48.11	+13	14	28.6	19.527 943	0.45	1.79	4	40	38
	17	2	17	47.28	13	14	23.4	19.511 805	0.45	1.79	4	36	41
	18	2	17	46.27	13	14	17.1	19.495 751	0.45	1.80	4	32	45
	19	2	17	45.07	13	14	09.9	19.479 786	0.45	1.80	4	28	47
	20	2	17	43.68	13	14	01.7	19.463 913	0.45	1.80	4	24	50
	21	2	17	42.10	13	13	52.6	19.448 138	0.45	1.80	4	20	53
	22	2	17	40.33	+13	13	42.5	19.432 465	0.45	1.80	4	16	55
	23	2	17	38.38	13	13	31.5	19.416 899	0.45	1.80	4	12	57
	24	2	17	36.25	13	13	19.6	19.401 444	0.45	1.81	4	08	59
	25	2	17	33.93	13	13	06.7	19.386 105	0.45	1.81	4	05	01
	26	2	17	31.43	13	12	53.0	19.370 887	0.45	1.81	4	01	02
	27	2	17	28.75	13	12	38.3	19.355 795	0.45	1.81	3	57	04
	28	2	17	25.88	+13	12	22.7	19.340 834	0.45	1.81	3	53	05
	29	2	17	22.82	13	12	06.2	19.326 009	0.46	1.81	3	49	06
	30	2	17	19.58	13	11	48.8	19.311 324	0.46	1.81	3	45	07
	31	2	17	16.16	13	11	30.4	19.296 785	0.46	1.81	3	41	07
Sept.	1	2	17	12.55	13	11	11.2	19.282 397	0.46	1.82	3	37	08
	2	2	17	08.76	13	10	50.9	19.268 164	0.46	1.82	3	33	08
	3	2	17	04.81	+13	10	29.9	19.254 091	0.46	1.82	3	29	08
	4	2	17	00.68	13	10	07.9	19.240 183	0.46	1.82	3	25	08
	5	2	16	56.38	13	09	45.1	19.226 444	0.46	1.82	3	21	08
	6	2	16	51.91	13	09	21.4	19.212 878	0.46	1.82	3	17	08
	7	2	16	47.28	13	08	56.9	19.199 489	0.46	1.82	3	13	07
	8	2	16	42.49	13	08	31.6	19.186 281	0.46	1.83	3	09	06
	9	2	16	37.52	+13	08	05.5	19.173 258	0.46	1.83	3	05	06
	10	2	16	32.40	13	07	38.6	19.160 424	0.46	1.83	3	01	05
	11	2	16	27.11	13	07	10.8	19.147 783	0.46	1.83	2	57	03
	12	2	16	21.66	13	06	42.3	19.135 339	0.46	1.83	2	53	02
	13	2	16	16.06	13	06	12.9	19.123 094	0.46	1.83	2	49	00
	14	2	16	10.29	13	05	42.8	19.111 054	0.46	1.83	2	44	59
	15	2	16	04.38	+13	05	11.8	19.099 221	0.46	1.83	2	40	57
	16	2	15	58.31	13	04	40.2	19.087 599	0.46	1.83	2	36	55
	17	2	15	52.10	13	04	07.7	19.076 193	0.46	1.84	2	32	53
	18	2	15	45.75	13	03	34.6	19.065 005	0.46	1.84	2	28	51
	19	2	15	39.25	13	03	00.7	19.054 039	0.46	1.84	2	24	48
	20	2	15	32.62	13	02	26.1	19.043 300	0.46	1.84	2	20	46
	21	2	15	25.85	+13	01	50.9	19.032 790	0.46	1.84	2	16	43
	22	2	15	18.95	13	01	15.0	19.022 514	0.46	1.84	2	12	40
	23	2	15	11.92	13	00	38.4	19.012 475	0.46	1.84	2	08	37
	24	2	15	04.75	13	00	01.2	19.002 677	0.46	1.84	2	04	34
	25	2	14	57.46	12	59	23.4	18.993 123	0.46	1.84	2	00	31
	26	2	14	50.04	12	58	44.9	18.983 818	0.46	1.84	1	56	28
	27	2	14	42.49	+12	58	05.8	18.974 764	0.46	1.85	1	52	25
	28	2	14	34.82	12	57	26.0	18.965 967	0.46	1.85	1	48	21
	29	2	14	27.03	12	56	45.6	18.957 428	0.46	1.85	1	44	17
	30	2	14	19.14	12	56	04.7	18.949 152	0.46	1.85	1	40	14
Oct.	1	2	14	11.13	+12	55	23.2	18.941 141	0.46	1.85	1	36	10

URANUS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	2	14	11.13	+12	55	23.2	18.941 141	0.46	1.85	1	36	10
	2	2	14	03.03	12	54	41.2	18.933 398	0.46	1.85	1	32	06
	3	2	13	54.83	12	53	58.7	18.925 926	0.46	1.85	1	28	02
	4	2	13	46.53	12	53	15.7	18.918 728	0.46	1.85	1	23	58
	5	2	13	38.14	12	52	32.2	18.911 805	0.47	1.85	1	19	53
	6	2	13	29.66	12	51	48.4	18.905 160	0.47	1.85	1	15	49
	7	2	13	21.10	+12	51	04.0	18.898 794	0.47	1.85	1	11	44
	8	2	13	12.44	12	50	19.3	18.892 711	0.47	1.85	1	07	40
	9	2	13	03.71	12	49	34.1	18.886 912	0.47	1.85	1	03	35
	10	2	12	54.90	12	48	48.5	18.881 398	0.47	1.85	0	59	31
	11	2	12	46.01	12	48	02.6	18.876 171	0.47	1.86	0	55	26
	12	2	12	37.05	12	47	16.3	18.871 234	0.47	1.86	0	51	21
	13	2	12	28.03	+12	46	29.7	18.866 588	0.47	1.86	0	47	16
	14	2	12	18.95	12	45	42.7	18.862 234	0.47	1.86	0	43	11
	15	2	12	09.81	12	44	55.5	18.858 174	0.47	1.86	0	39	06
	16	2	12	00.62	12	44	07.9	18.854 410	0.47	1.86	0	35	01
	17	2	11	51.39	12	43	20.2	18.850 943	0.47	1.86	0	30	56
	18	2	11	42.11	12	42	32.2	18.847 775	0.47	1.86	0	26	51
	19	2	11	32.79	+12	41	44.0	18.844 906	0.47	1.86	0	22	46
	20	2	11	23.43	12	40	55.7	18.842 339	0.47	1.86	0	18	41
	21	2	11	14.03	12	40	07.2	18.840 075	0.47	1.86	0	14	35
	22	2	11	04.61	12	39	18.5	18.838 115	0.47	1.86	0	10	30
	23	2	10	55.15	12	38	29.7	18.836 460	0.47	1.86	0	06	25
	24	2	10	45.67	12	37	40.8	18.835 112	0.47	1.86	0	02	19
	25	2	10	36.16	+12	36	51.7	18.834 071	0.47	1.86	23	54	09
	26	2	10	26.64	12	36	02.6	18.833 340	0.47	1.86	23	50	03
	27	2	10	17.11	12	35	13.4	18.832 918	0.47	1.86	23	45	58
	28	2	10	07.57	12	34	24.1	18.832 806	0.47	1.86	23	41	53
	29	2	09	58.04	12	33	34.9	18.833 004	0.47	1.86	23	37	47
	30	2	09	48.51	12	32	45.7	18.833 513	0.47	1.86	23	33	42
	31	2	09	39.00	+12	31	56.5	18.834 332	0.47	1.86	23	29	36
Nov.	1	2	09	29.50	12	31	07.5	18.835 461	0.47	1.86	23	25	31
	2	2	09	20.01	12	30	18.5	18.836 900	0.47	1.86	23	21	26
	3	2	09	10.54	12	29	29.7	18.838 647	0.47	1.86	23	17	20
	4	2	09	01.10	12	28	41.0	18.840 703	0.47	1.86	23	13	15
	5	2	08	51.68	12	27	52.4	18.843 065	0.47	1.86	23	09	10
	6	2	08	42.29	+12	27	04.0	18.845 734	0.47	1.86	23	05	05
	7	2	08	32.94	12	26	15.8	18.848 708	0.47	1.86	23	00	60
	8	2	08	23.62	12	25	27.8	18.851 987	0.47	1.86	22	56	54
	9	2	08	14.35	12	24	40.0	18.855 568	0.47	1.86	22	52	49
	10	2	08	05.13	12	23	52.5	18.859 452	0.47	1.86	22	48	44
	11	2	07	55.96	12	23	05.3	18.863 635	0.47	1.86	22	44	39
	12	2	07	46.86	+12	22	18.3	18.868 118	0.47	1.86	22	40	34
	13	2	07	37.81	12	21	31.7	18.872 899	0.47	1.86	22	36	30
	14	2	07	28.83	12	20	45.5	18.877 976	0.47	1.86	22	32	25
	15	2	07	19.92	12	19	59.7	18.883 348	0.47	1.85	22	28	20
	16	2	07	11.08	+12	19	14.2	18.889 014	0.47	1.85	22	24	16

URANUS, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	2	07	11.08	+12	19	14.2	18.889 014	0.47	1.85	22	24	16
	17	2	07	02.32	12	18	29.2	18.894 971	0.47	1.85	22	20	11
	18	2	06	53.64	12	17	44.6	18.901 219	0.47	1.85	22	16	06
	19	2	06	45.04	12	17	00.4	18.907 756	0.47	1.85	22	12	02
	20	2	06	36.52	12	16	16.7	18.914 579	0.46	1.85	22	07	58
	21	2	06	28.08	12	15	33.4	18.921 688	0.46	1.85	22	03	54
	22	2	06	19.74	+12	14	50.6	18.929 080	0.46	1.85	21	59	49
	23	2	06	11.49	12	14	08.3	18.936 754	0.46	1.85	21	55	45
	24	2	06	03.35	12	13	26.6	18.944 706	0.46	1.85	21	51	42
	25	2	05	55.32	12	12	45.4	18.952 935	0.46	1.85	21	47	38
	26	2	05	47.39	12	12	04.8	18.961 437	0.46	1.85	21	43	34
	27	2	05	39.59	12	11	24.9	18.970 210	0.46	1.85	21	39	30
	28	2	05	31.90	+12	10	45.6	18.979 251	0.46	1.85	21	35	27
	29	2	05	24.34	12	10	06.9	18.988 556	0.46	1.84	21	31	24
	30	2	05	16.90	12	09	28.9	18.998 122	0.46	1.84	21	27	21
Dec.	1	2	05	09.58	12	08	51.6	19.007 946	0.46	1.84	21	23	17
	2	2	05	02.39	12	08	15.0	19.018 023	0.46	1.84	21	19	14
	3	2	04	55.33	12	07	39.1	19.028 350	0.46	1.84	21	15	12
	4	2	04	48.41	+12	07	04.0	19.038 923	0.46	1.84	21	11	09
	5	2	04	41.62	12	06	29.5	19.049 739	0.46	1.84	21	07	06
	6	2	04	34.97	12	05	55.8	19.060 794	0.46	1.84	21	03	04
	7	2	04	28.47	12	05	22.9	19.072 083	0.46	1.84	20	59	02
	8	2	04	22.12	12	04	50.8	19.083 604	0.46	1.84	20	54	60
	9	2	04	15.92	12	04	19.5	19.095 351	0.46	1.83	20	50	58
	10	2	04	09.87	+12	03	49.0	19.107 321	0.46	1.83	20	46	56
	11	2	04	03.98	12	03	19.3	19.119 510	0.46	1.83	20	42	54
	12	2	03	58.25	12	02	50.6	19.131 915	0.46	1.83	20	38	53
	13	2	03	52.69	12	02	22.7	19.144 530	0.46	1.83	20	34	52
	14	2	03	47.28	12	01	55.7	19.157 353	0.46	1.83	20	30	50
	15	2	03	42.04	12	01	29.6	19.170 379	0.46	1.83	20	26	49
	16	2	03	36.96	+12	01	04.3	19.183 604	0.46	1.83	20	22	49
	17	2	03	32.05	12	00	40.0	19.197 025	0.46	1.82	20	18	48
	18	2	03	27.30	12	00	16.6	19.210 637	0.46	1.82	20	14	47
	19	2	03	22.73	11	59	54.1	19.224 437	0.46	1.82	20	10	47
	20	2	03	18.33	11	59	32.5	19.238 419	0.46	1.82	20	06	47
	21	2	03	14.10	11	59	11.8	19.252 580	0.46	1.82	20	02	47
	22	2	03	10.06	+11	58	52.1	19.266 914	0.46	1.82	19	58	47
	23	2	03	06.20	11	58	33.4	19.281 418	0.46	1.82	19	54	48
	24	2	03	02.53	11	58	15.7	19.296 086	0.46	1.81	19	50	48
	25	2	02	59.05	11	57	59.0	19.310 914	0.46	1.81	19	46	49
	26	2	02	55.75	11	57	43.4	19.325 896	0.46	1.81	19	42	50
	27	2	02	52.65	11	57	28.7	19.341 026	0.45	1.81	19	38	51
	28	2	02	49.73	+11	57	15.1	19.356 300	0.45	1.81	19	34	52
	29	2	02	47.00	11	57	02.5	19.371 712	0.45	1.81	19	30	54
	30	2	02	44.46	11	56	51.0	19.387 257	0.45	1.81	19	26	56
	31	2	02	42.11	11	56	40.5	19.402 930	0.45	1.80	19	22	58
	32	2	02	39.96	+11	56	31.0	19.418 725	0.45	1.80	19	19	00

NEPTUNE, 2019
HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector	Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector
Jan.	1	345 46 40.4	-0 59 01.4	29.938 68	Apr.	3	346 20 11.6	-0 59 52.6	29.937 22
	3	345 47 24.1	0 59 02.5	29.938 65		5	346 20 55.4	0 59 53.7	29.937 18
	5	345 48 07.8	0 59 03.6	29.938 62		7	346 21 39.1	0 59 54.8	29.937 15
	7	345 48 51.5	0 59 04.7	29.938 58		9	346 22 22.9	0 59 55.9	29.937 12
	9	345 49 35.3	0 59 05.9	29.938 55		11	346 23 06.6	0 59 57.0	29.937 09
	11	345 50 19.0	0 59 07.0	29.938 52		13	346 23 50.3	0 59 58.1	29.937 06
	13	345 51 02.7	-0 59 08.1	29.938 49		15	346 24 34.1	-0 59 59.2	29.937 03
	15	345 51 46.4	0 59 09.2	29.938 46		17	346 25 17.8	1 00 00.3	29.937 00
	17	345 52 30.1	0 59 10.3	29.938 42		19	346 26 01.5	1 00 01.4	29.936 96
	19	345 53 13.8	0 59 11.4	29.938 39		21	346 26 45.3	1 00 02.5	29.936 93
	21	345 53 57.6	0 59 12.5	29.938 36		23	346 27 29.0	1 00 03.6	29.936 90
	23	345 54 41.3	0 59 13.7	29.938 33		25	346 28 12.8	1 00 04.7	29.936 87
	25	345 55 25.0	-0 59 14.8	29.938 29		27	346 28 56.5	-1 00 05.9	29.936 84
	27	345 56 08.7	0 59 15.9	29.938 26		29	346 29 40.2	1 00 06.9	29.936 81
	29	345 56 52.4	0 59 17.0	29.938 23	May	1	346 30 24.0	1 00 08.1	29.936 77
	31	345 57 36.2	0 59 18.1	29.938 20		3	346 31 07.7	1 00 09.2	29.936 74
Feb.	2	345 58 19.9	0 59 19.2	29.938 17		5	346 31 51.4	1 00 10.3	29.936 71
	4	345 59 03.6	0 59 20.3	29.938 14		7	346 32 35.2	1 00 11.4	29.936 68
	6	345 59 47.3	-0 59 21.5	29.938 10		9	346 33 18.9	-1 00 12.5	29.936 65
	8	346 00 31.0	0 59 22.6	29.938 07		11	346 34 02.6	1 00 13.6	29.936 62
	10	346 01 14.8	0 59 23.7	29.938 04		13	346 34 46.4	1 00 14.7	29.936 59
	12	346 01 58.5	0 59 24.8	29.938 01		15	346 35 30.1	1 00 15.8	29.936 55
	14	346 02 42.2	0 59 25.9	29.937 98		17	346 36 13.9	1 00 16.9	29.936 52
	16	346 03 25.9	0 59 27.0	29.937 94		19	346 36 57.6	1 00 18.0	29.936 49
	18	346 04 09.6	-0 59 28.1	29.937 91		21	346 37 41.4	-1 00 19.1	29.936 46
	20	346 04 53.4	0 59 29.3	29.937 88		23	346 38 25.1	1 00 20.2	29.936 43
	22	346 05 37.1	0 59 30.3	29.937 85		25	346 39 08.8	1 00 21.3	29.936 40
	24	346 06 20.8	0 59 31.5	29.937 82		27	346 39 52.6	1 00 22.4	29.936 37
	26	346 07 04.6	0 59 32.6	29.937 79		29	346 40 36.3	1 00 23.5	29.936 33
	28	346 07 48.3	0 59 33.7	29.937 75		31	346 41 20.1	1 00 24.6	29.936 30
Mar.	2	346 08 32.0	-0 59 34.8	29.937 72	June	2	346 42 03.8	-1 00 25.7	29.936 27
	4	346 09 15.7	0 59 35.9	29.937 69		4	346 42 47.6	1 00 26.9	29.936 24
	6	346 09 59.5	0 59 37.0	29.937 66		6	346 43 31.3	1 00 27.9	29.936 21
	8	346 10 43.2	0 59 38.1	29.937 63		8	346 44 15.1	1 00 29.0	29.936 18
	10	346 11 26.9	0 59 39.3	29.937 59		10	346 44 58.8	1 00 30.2	29.936 15
	12	346 12 10.6	0 59 40.4	29.937 56		12	346 45 42.6	1 00 31.3	29.936 11
	14	346 12 54.4	-0 59 41.4	29.937 53		14	346 46 26.3	-1 00 32.4	29.936 08
	16	346 13 38.1	0 59 42.6	29.937 50		16	346 47 10.1	1 00 33.5	29.936 05
	18	346 14 21.8	0 59 43.7	29.937 47		18	346 47 53.8	1 00 34.6	29.936 02
	20	346 15 05.6	0 59 44.8	29.937 44		20	346 48 37.6	1 00 35.7	29.935 99
	22	346 15 49.3	0 59 45.9	29.937 41		22	346 49 21.3	1 00 36.8	29.935 96
	24	346 16 33.0	0 59 47.0	29.937 37		24	346 50 05.0	1 00 37.9	29.935 93
	26	346 17 16.7	-0 59 48.1	29.937 34		26	346 50 48.8	-1 00 39.0	29.935 89
	28	346 18 00.5	0 59 49.2	29.937 31		28	346 51 32.5	1 00 40.1	29.935 86
	30	346 18 44.2	0 59 50.3	29.937 28		30	346 52 16.3	1 00 41.2	29.935 83
Apr.	1	346 19 27.9	0 59 51.4	29.937 25	July	2	346 53 00.1	1 00 42.3	29.935 80
	3	346 20 11.6	-0 59 52.6	29.937 22		4	346 53 43.8	-1 00 43.4	29.935 77

NEPTUNE, 2019

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector	Date	Heliocentric Longitude	Heliocentric Latitude	Radius Vector
	° ' "	° ' "			° ' "	° ' "	
July 2	346 53 00.1	-1 00 42.3	29.935 80	Oct. 2	347 26 33.0	-1 01 32.8	29.934 36
4	346 53 43.8	1 00 43.4	29.935 77	4	347 27 16.8	1 01 33.9	29.934 32
6	346 54 27.6	1 00 44.5	29.935 74	6	347 28 00.5	1 01 35.0	29.934 29
8	346 55 11.3	1 00 45.6	29.935 71	8	347 28 44.3	1 01 36.1	29.934 26
10	346 55 55.0	1 00 46.7	29.935 67	10	347 29 28.1	1 01 37.2	29.934 23
12	346 56 38.8	1 00 47.8	29.935 64	12	347 30 11.9	1 01 38.2	29.934 20
14	346 57 22.6	-1 00 48.9	29.935 61	14	347 30 55.6	-1 01 39.3	29.934 17
16	346 58 06.3	1 00 50.0	29.935 58	16	347 31 39.4	1 01 40.4	29.934 14
18	346 58 50.1	1 00 51.1	29.935 55	18	347 32 23.2	1 01 41.5	29.934 10
20	346 59 33.8	1 00 52.2	29.935 52	20	347 33 07.0	1 01 42.6	29.934 07
22	347 00 17.6	1 00 53.3	29.935 49	22	347 33 50.7	1 01 43.7	29.934 04
24	347 01 01.4	1 00 54.4	29.935 45	24	347 34 34.5	1 01 44.8	29.934 01
26	347 01 45.1	-1 00 55.5	29.935 42	26	347 35 18.3	-1 01 45.9	29.933 98
28	347 02 28.8	1 00 56.6	29.935 39	28	347 36 02.0	1 01 47.0	29.933 95
30	347 03 12.6	1 00 57.7	29.935 36	30	347 36 45.8	1 01 48.1	29.933 92
Aug. 1	347 03 56.4	1 00 58.8	29.935 33	Nov. 1	347 37 29.6	1 01 49.2	29.933 88
3	347 04 40.1	1 00 59.9	29.935 30	3	347 38 13.4	1 01 50.3	29.933 85
5	347 05 23.9	1 01 01.0	29.935 27	5	347 38 57.1	1 01 51.4	29.933 82
7	347 06 07.6	-1 01 02.1	29.935 23	7	347 39 40.9	-1 01 52.4	29.933 79
9	347 06 51.4	1 01 03.2	29.935 20	9	347 40 24.7	1 01 53.5	29.933 76
11	347 07 35.2	1 01 04.3	29.935 17	11	347 41 08.5	1 01 54.6	29.933 73
13	347 08 18.9	1 01 05.4	29.935 14	13	347 41 52.3	1 01 55.7	29.933 70
15	347 09 02.7	1 01 06.5	29.935 11	15	347 42 36.0	1 01 56.8	29.933 66
17	347 09 46.4	1 01 07.6	29.935 08	17	347 43 19.8	1 01 57.9	29.933 63
19	347 10 30.2	-1 01 08.7	29.935 05	19	347 44 03.6	-1 01 59.0	29.933 60
21	347 11 13.9	1 01 09.8	29.935 01	21	347 44 47.4	1 02 00.1	29.933 57
23	347 11 57.7	1 01 10.9	29.934 98	23	347 45 31.1	1 02 01.2	29.933 54
25	347 12 41.5	1 01 12.0	29.934 95	25	347 46 14.9	1 02 02.3	29.933 51
27	347 13 25.2	1 01 13.1	29.934 92	27	347 46 58.7	1 02 03.3	29.933 48
29	347 14 09.0	1 01 14.2	29.934 89	29	347 47 42.5	1 02 04.5	29.933 44
31	347 14 52.8	-1 01 15.2	29.934 86	Dec. 1	347 48 26.3	-1 02 05.5	29.933 41
Sept. 2	347 15 36.5	1 01 16.4	29.934 83	3	347 49 10.0	1 02 06.6	29.933 38
4	347 16 20.3	1 01 17.4	29.934 79	5	347 49 53.8	1 02 07.7	29.933 35
6	347 17 04.0	1 01 18.6	29.934 76	7	347 50 37.6	1 02 08.8	29.933 32
8	347 17 47.8	1 01 19.6	29.934 73	9	347 51 21.4	1 02 09.9	29.933 29
10	347 18 31.6	1 01 20.7	29.934 70	11	347 52 05.2	1 02 11.0	29.933 25
12	347 19 15.3	-1 01 21.8	29.934 67	13	347 52 49.0	-1 02 12.1	29.933 22
14	347 19 59.1	1 01 22.9	29.934 64	15	347 53 32.8	1 02 13.2	29.933 19
16	347 20 42.9	1 01 24.0	29.934 61	17	347 54 16.5	1 02 14.2	29.933 16
18	347 21 26.6	1 01 25.1	29.934 57	19	347 55 00.3	1 02 15.3	29.933 13
20	347 22 10.4	1 01 26.2	29.934 54	21	347 55 44.1	1 02 16.4	29.933 10
22	347 22 54.2	1 01 27.3	29.934 51	23	347 56 27.9	1 02 17.5	29.933 07
24	347 23 38.0	-1 01 28.4	29.934 48	25	347 57 11.7	-1 02 18.6	29.933 03
26	347 24 21.7	1 01 29.5	29.934 45	27	347 57 55.5	1 02 19.7	29.933 00
28	347 25 05.5	1 01 30.6	29.934 42	29	347 58 39.3	1 02 20.8	29.932 97
30	347 25 49.2	1 01 31.7	29.934 39	31	347 59 23.0	1 02 21.9	29.932 94
Oct. 2	347 26 33.0	-1 01 32.8	29.934 36	33	348 00 06.8	-1 02 22.9	29.932 91

NEPTUNE, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"
Jan.	0	344	03	38.0	-0	58	13.8
	1	344	04	50.8	0	58	12.5
	2	344	06	05.4	0	58	11.3
	3	344	07	21.9	0	58	10.0
	4	344	08	40.2	0	58	08.8
	5	344	10	00.2	0	58	07.7
	6	344	11	22.0	-0	58	06.5
	7	344	12	45.4	0	58	05.3
	8	344	14	10.5	0	58	04.2
	9	344	15	37.3	0	58	03.1
	10	344	17	05.6	0	58	02.0
	11	344	18	35.5	0	58	01.0
	12	344	20	07.0	-0	57	59.9
	13	344	21	40.1	0	57	58.9
	14	344	23	14.7	0	57	57.9
	15	344	24	50.8	0	57	56.9
	16	344	26	28.4	0	57	55.9
	17	344	28	07.6	0	57	55.0
	18	344	29	48.2	-0	57	54.1
	19	344	31	30.4	0	57	53.2
	20	344	33	13.9	0	57	52.3
	21	344	34	58.8	0	57	51.4
	22	344	36	44.9	0	57	50.6
	23	344	38	32.4	0	57	49.8
	24	344	40	21.0	-0	57	49.0
	25	344	42	10.9	0	57	48.3
	26	344	44	02.0	0	57	47.6
	27	344	45	54.3	0	57	46.9
	28	344	47	47.9	0	57	46.2
	29	344	49	42.7	0	57	45.6
	30	344	51	38.6	-0	57	45.0
	31	344	53	35.7	0	57	44.4
Feb.	1	344	55	33.9	0	57	43.8
	2	344	57	33.2	0	57	43.3
	3	344	59	33.5	0	57	42.8
	4	345	01	34.7	0	57	42.3
	5	345	03	36.9	-0	57	41.9
	6	345	05	40.0	0	57	41.5
	7	345	07	43.9	0	57	41.1
	8	345	09	48.7	0	57	40.7
	9	345	11	54.4	0	57	40.4
	10	345	14	00.8	0	57	40.1
	11	345	16	08.0	-0	57	39.9
	12	345	18	16.0	0	57	39.6
	13	345	20	24.8	0	57	39.4
	14	345	22	34.3	0	57	39.2
	15	345	24	44.4	-0	57	39.1

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"
Feb.	15	345	24	44.4	-0	57	39.1
	16	345	26	55.3	0	57	39.0
	17	345	29	06.7	0	57	38.9
	18	345	31	18.6	0	57	38.8
	19	345	33	31.1	0	57	38.8
	20	345	35	43.9	0	57	38.8
	21	345	37	57.2	-0	57	38.8
	22	345	40	10.9	0	57	38.9
	23	345	42	25.0	0	57	39.0
	24	345	44	39.5	0	57	39.1
	25	345	46	54.4	0	57	39.3
	26	345	49	09.7	0	57	39.5
	27	345	51	25.4	-0	57	39.7
	28	345	53	41.3	0	57	40.0
Mar.	1	345	55	57.4	0	57	40.3
	2	345	58	13.8	0	57	40.6
	3	346	00	30.3	0	57	41.0
	4	346	02	46.9	0	57	41.4
	5	346	05	03.6	-0	57	41.9
	6	346	07	20.3	0	57	42.5
	7	346	09	36.8	0	57	43.2
	8	346	11	53.3	0	57	43.5
	9	346	14	10.0	0	57	43.9
	10	346	16	26.6	0	57	44.4
	11	346	18	43.2	-0	57	45.0
	12	346	20	59.7	0	57	45.7
	13	346	23	16.0	0	57	46.3
	14	346	25	32.2	0	57	47.0
	15	346	27	48.2	0	57	47.8
	16	346	30	04.0	0	57	48.6
	17	346	32	19.5	-0	57	49.4
	18	346	34	34.6	0	57	50.2
	19	346	36	49.3	0	57	51.0
	20	346	39	03.6	0	57	51.9
	21	346	41	17.5	0	57	52.9
	22	346	43	30.9	0	57	53.8
	23	346	45	43.9	-0	57	54.8
	24	346	47	56.4	0	57	55.9
	25	346	50	08.5	0	57	56.9
	26	346	52	20.1	0	57	58.0
	27	346	54	31.2	0	57	59.1
	28	346	56	41.7	0	58	00.3
	29	346	58	51.6	-0	58	01.5
	30	347	01	00.8	0	58	02.7
	31	347	03	09.3	0	58	03.9
Apr.	1	347	05	17.1	0	58	05.2
	2	347	07	24.1	-0	58	06.5

NEPTUNE, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"	Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Apr.	1	347	05	17.1	-0	58	05.2	May	17	348	23	00.6	-0	59	31.9
	2	347	07	24.1	0	58	06.5		18	348	24	07.3	0	59	34.3
	3	347	09	30.3	0	58	07.8		19	348	25	12.3	0	59	36.7
	4	347	11	35.6	0	58	09.2		20	348	26	15.6	0	59	39.1
	5	347	13	40.2	0	58	10.6		21	348	27	17.1	0	59	41.6
	6	347	15	43.9	0	58	12.0		22	348	28	16.9	0	59	44.0
	7	347	17	46.7	-0	58	13.5		23	348	29	14.8	-0	59	46.5
	8	347	19	48.6	0	58	14.9		24	348	30	10.9	0	59	48.9
	9	347	21	49.7	0	58	16.4		25	348	31	05.2	0	59	51.4
	10	347	23	49.8	0	58	18.0		26	348	31	57.5	0	59	53.9
	11	347	25	49.0	0	58	19.5		27	348	32	48.0	0	59	56.4
	12	347	27	47.1	0	58	21.1		28	348	33	36.6	0	59	58.9
	13	347	29	44.3	-0	58	22.7		29	348	34	23.3	-1	00	01.4
	14	347	31	40.3	0	58	24.4		30	348	35	08.1	1	00	03.9
	15	347	33	35.1	0	58	26.0		31	348	35	51.0	1	00	06.5
	16	347	35	28.8	0	58	27.7	June	1	348	36	32.1	1	00	09.0
	17	347	37	21.3	0	58	29.4		2	348	37	11.3	1	00	11.6
	18	347	39	12.6	0	58	31.2		3	348	37	48.6	1	00	14.1
	19	347	41	02.8	-0	58	33.0		4	348	38	24.0	-1	00	16.7
	20	347	42	51.7	0	58	34.8		5	348	38	57.5	1	00	19.3
	21	347	44	39.5	0	58	36.6		6	348	39	29.1	1	00	21.8
	22	347	46	26.1	0	58	38.5		7	348	39	58.7	1	00	24.4
	23	347	48	11.5	0	58	40.3		8	348	40	26.3	1	00	27.0
	24	347	49	55.6	0	58	42.2		9	348	40	51.9	1	00	29.6
	25	347	51	38.3	-0	58	44.2		10	348	41	15.4	-1	00	32.2
	26	347	53	19.7	0	58	46.1		11	348	41	37.0	1	00	34.8
	27	347	54	59.8	0	58	48.1		12	348	41	56.6	1	00	37.4
	28	347	56	38.4	0	58	50.1		13	348	42	14.3	1	00	40.0
	29	347	58	15.6	0	58	52.1		14	348	42	30.1	1	00	42.6
	30	347	59	51.3	0	58	54.2		15	348	42	44.0	1	00	45.2
May	1	348	01	25.5	-0	58	56.2		16	348	42	55.9	-1	00	47.8
	2	348	02	58.2	0	58	58.3		17	348	43	06.0	1	00	50.4
	3	348	04	29.5	0	59	00.4		18	348	43	14.1	1	00	53.0
	4	348	05	59.2	0	59	02.6		19	348	43	20.2	1	00	55.6
	5	348	07	27.5	0	59	04.7		20	348	43	24.4	1	00	58.2
	6	348	08	54.2	0	59	06.9		21	348	43	26.6	1	01	00.8
	7	348	10	19.4	-0	59	09.1		22	348	43	26.8	-1	01	03.4
	8	348	11	43.1	0	59	11.3		23	348	43	25.0	1	01	06.0
	9	348	13	05.1	0	59	13.5		24	348	43	21.3	1	01	08.6
	10	348	14	25.6	0	59	15.7		25	348	43	15.6	1	01	11.1
	11	348	15	44.3	0	59	18.0		26	348	43	07.9	1	01	13.7
	12	348	17	01.3	0	59	20.3		27	348	42	58.4	1	01	16.3
	13	348	18	16.6	-0	59	22.6		28	348	42	46.9	-1	01	18.8
	14	348	19	30.2	0	59	24.9		29	348	42	33.5	1	01	21.4
	15	348	20	42.0	0	59	27.2		30	348	42	18.2	1	01	23.9
	16	348	21	52.2	0	59	29.6	July	1	348	42	01.1	1	01	26.5
	17	348	23	00.6	-0	59	31.9		2	348	41	42.1	-1	01	29.0

NEPTUNE, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude			Date		Apparent Geocentric Longitude			Apparent Geocentric Latitude		
		°	'	"	°	'	"			°	'	"	°	'	"
July	1	348	42	01.1	-1	01	26.5	Aug.	16	347	58	45.2	-1	03	03.1
	2	348	41	42.1	1	01	29.0		17	347	57	17.5	1	03	04.6
	3	348	41	21.3	1	01	31.5		18	347	55	49.0	1	03	06.0
	4	348	40	58.5	1	01	34.0		19	347	54	19.5	1	03	07.4
	5	348	40	33.8	1	01	36.5		20	347	52	49.3	1	03	08.8
	6	348	40	07.2	1	01	38.9		21	347	51	18.2	1	03	10.1
	7	348	39	38.7	-1	01	41.4		22	347	49	46.5	-1	03	11.4
	8	348	39	08.3	1	01	43.9		23	347	48	14.0	1	03	12.6
	9	348	38	36.1	1	01	46.3		24	347	46	40.9	1	03	13.9
	10	348	38	02.0	1	01	48.7		25	347	45	07.2	1	03	15.0
	11	348	37	26.3	1	01	51.1		26	347	43	32.9	1	03	16.2
	12	348	36	48.7	1	01	53.5		27	347	41	58.0	1	03	17.3
	13	348	36	09.5	-1	01	55.9		28	347	40	22.6	-1	03	18.3
	14	348	35	28.6	1	01	58.3		29	347	38	46.6	1	03	19.4
	15	348	34	45.9	1	02	00.6		30	347	37	10.0	1	03	20.4
	16	348	34	01.6	1	02	02.9		31	347	35	33.0	1	03	21.3
	17	348	33	15.5	1	02	05.2	Sept.	1	347	33	55.5	1	03	22.2
	18	348	32	27.8	1	02	07.5		2	347	32	17.7	1	03	23.1
	19	348	31	38.3	-1	02	09.8		3	347	30	39.6	-1	03	24.0
	20	348	30	47.2	1	02	12.1		4	347	29	01.2	1	03	24.8
	21	348	29	54.4	1	02	14.3		5	347	27	22.7	1	03	25.5
	22	348	28	59.9	1	02	16.5		6	347	25	44.0	1	03	26.3
	23	348	28	03.9	1	02	18.7		7	347	24	05.2	1	03	27.0
	24	348	27	06.3	1	02	20.8		8	347	22	26.2	1	03	27.6
	25	348	26	07.2	-1	02	23.0		9	347	20	47.2	-1	03	28.2
	26	348	25	06.5	1	02	25.1		10	347	19	08.1	1	03	28.8
	27	348	24	04.4	1	02	27.2		11	347	17	29.0	1	03	29.3
	28	348	23	00.9	1	02	29.2		12	347	15	49.8	1	03	29.8
	29	348	21	55.9	1	02	31.3		13	347	14	10.7	1	03	30.3
	30	348	20	49.5	1	02	33.3		14	347	12	31.6	1	03	30.7
	31	348	19	41.7	-1	02	35.3		15	347	10	52.7	-1	03	31.1
Aug.	1	348	18	32.4	1	02	37.2		16	347	09	14.0	1	03	31.4
	2	348	17	21.8	1	02	39.2		17	347	07	35.4	1	03	31.7
	3	348	16	09.7	1	02	41.1		18	347	05	57.1	1	03	32.0
	4	348	14	56.3	1	02	42.9		19	347	04	19.2	1	03	32.2
	5	348	13	41.6	1	02	44.8		20	347	02	41.6	1	03	32.4
	6	348	12	25.6	-1	02	46.6		21	347	01	04.4	-1	03	32.5
	7	348	11	08.4	1	02	48.4		22	346	59	27.7	1	03	32.6
	8	348	09	50.1	1	02	50.1		23	346	57	51.4	1	03	32.7
	9	348	08	30.7	1	02	51.9		24	346	56	15.5	1	03	32.7
	10	348	07	10.2	1	02	53.6		25	346	54	40.2	1	03	32.7
	11	348	05	48.6	1	02	55.2		26	346	53	05.3	1	03	32.6
	12	348	04	26.0	-1	02	56.9		27	346	51	31.0	-1	03	32.5
	13	348	03	02.3	1	02	58.5		28	346	49	57.2	1	03	32.4
	14	348	01	37.6	1	03	00.0		29	346	48	24.1	1	03	32.2
	15	348	00	11.9	1	03	01.6		30	346	46	51.7	1	03	32.0
	16	347	58	45.2	-1	03	03.1	Oct.	1	346	45	20.1	-1	03	31.8

NEPTUNE, 2019
GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"	Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Oct.	1	346	45	20.1	-1	03	31.8	Nov.	16	345	57	51.4	-1	02	47.3
	2	346	43	49.4	1	03	31.5		17	345	57	28.9	1	02	45.8
	3	346	42	19.5	1	03	31.2		18	345	57	08.5	1	02	44.3
	4	346	40	50.5	1	03	30.8		19	345	56	50.0	1	02	42.7
	5	346	39	22.5	1	03	30.4		20	345	56	33.5	1	02	41.2
	6	346	37	55.3	1	03	30.0		21	345	56	18.9	1	02	39.7
	7	346	36	29.1	-1	03	29.6		22	345	56	06.3	-1	02	38.1
	8	346	35	03.9	1	03	29.1		23	345	55	55.7	1	02	36.5
	9	346	33	39.7	1	03	28.5		24	345	55	47.2	1	02	35.0
	10	346	32	16.5	1	03	28.0		25	345	55	40.8	1	02	33.4
	11	346	30	54.3	1	03	27.4		26	345	55	36.5	1	02	31.8
	12	346	29	33.3	1	03	26.8		27	345	55	34.3	1	02	30.2
	13	346	28	13.4	-1	03	26.1		28	345	55	34.3	-1	02	28.6
	14	346	26	54.7	1	03	25.4		29	345	55	36.3	1	02	27.0
	15	346	25	37.2	1	03	24.7		30	345	55	40.4	1	02	25.4
	16	346	24	21.1	1	03	23.9	Dec.	1	345	55	46.6	1	02	23.8
	17	346	23	06.2	1	03	23.1		2	345	55	54.8	1	02	22.2
	18	346	21	52.7	1	03	22.3		3	345	56	05.1	1	02	20.6
	19	346	20	40.6	-1	03	21.4		4	345	56	17.5	-1	02	19.0
	20	346	19	29.8	1	03	20.5		5	345	56	31.8	1	02	17.3
	21	346	18	20.5	1	03	19.6		6	345	56	48.3	1	02	15.7
	22	346	17	12.6	1	03	18.7		7	345	57	06.8	1	02	14.1
	23	346	16	06.0	1	03	17.7		8	345	57	27.4	1	02	12.5
	24	346	15	00.9	1	03	16.7		9	345	57	50.2	1	02	10.8
	25	346	13	57.3	-1	03	15.7		10	345	58	15.0	-1	02	09.2
	26	346	12	55.2	1	03	14.6		11	345	58	41.9	1	02	07.6
	27	346	11	54.6	1	03	13.5		12	345	59	10.9	1	02	06.0
	28	346	10	55.7	1	03	12.4		13	345	59	42.0	1	02	04.4
	29	346	09	58.4	1	03	11.3		14	346	00	15.2	1	02	02.8
	30	346	09	02.9	1	03	10.1		15	346	00	50.4	1	02	01.2
	31	346	08	09.1	-1	03	09.0		16	346	01	27.6	-1	01	59.6
Nov.	1	346	07	17.0	1	03	07.8		17	346	02	06.8	1	01	58.0
	2	346	06	26.6	1	03	06.5		18	346	02	48.0	1	01	56.4
	3	346	05	38.0	1	03	05.3		19	346	03	31.1	1	01	54.8
	4	346	04	51.1	1	03	04.0		20	346	04	16.2	1	01	53.3
	5	346	04	06.0	1	03	02.7		21	346	05	03.3	1	01	51.7
	6	346	03	22.6	-1	03	01.4		22	346	05	52.5	-1	01	50.2
	7	346	02	41.0	1	03	00.1		23	346	06	43.6	1	01	48.7
	8	346	02	01.2	1	02	58.7		24	346	07	36.9	1	01	47.1
	9	346	01	23.2	1	02	57.4		25	346	08	32.1	1	01	45.6
	10	346	00	47.1	1	02	56.0		26	346	09	29.3	1	01	44.1
	11	346	00	13.0	1	02	54.6		27	346	10	28.4	1	01	42.7
	12	345	59	40.7	-1	02	53.1		28	346	11	29.5	-1	01	41.2
	13	345	59	10.4	1	02	51.7		29	346	12	32.4	1	01	39.7
	14	345	58	42.1	1	02	50.2		30	346	13	37.1	1	01	38.3
	15	345	58	15.7	1	02	48.8		31	346	14	43.7	1	01	36.9
	16	345	57	51.4	-1	02	47.3		32	346	15	52.1	-1	01	35.5

NEPTUNE, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Jan.	0	23	02	46.21	-7	09	57.9	30.343 745	0.29	1.10	16	22	39
	1	23	02	50.69	7	09	28.7	30.359 395	0.29	1.10	16	18	47
	2	23	02	55.28	7	08	58.8	30.374 915	0.29	1.10	16	14	56
	3	23	02	59.99	7	08	28.2	30.390 299	0.29	1.10	16	11	05
	4	23	03	04.81	7	07	56.9	30.405 542	0.29	1.10	16	07	14
	5	23	03	09.74	7	07	24.9	30.420 641	0.29	1.10	16	03	23
	6	23	03	14.78	-7	06	52.3	30.435 590	0.29	1.10	15	59	32
	7	23	03	19.92	7	06	19.1	30.450 384	0.29	1.10	15	55	41
	8	23	03	25.17	7	05	45.3	30.465 019	0.29	1.10	15	51	51
	9	23	03	30.51	7	05	10.8	30.479 491	0.29	1.10	15	48	00
	10	23	03	35.96	7	04	35.7	30.493 794	0.29	1.10	15	44	10
	11	23	03	41.51	7	04	00.1	30.507 925	0.29	1.10	15	40	20
	12	23	03	47.15	-7	03	23.8	30.521 880	0.29	1.10	15	36	29
	13	23	03	52.89	7	02	47.0	30.535 655	0.29	1.10	15	32	39
	14	23	03	58.72	7	02	09.6	30.549 245	0.29	1.10	15	28	49
	15	23	04	04.65	7	01	31.6	30.562 648	0.29	1.10	15	24	59
	16	23	04	10.68	7	00	53.0	30.575 858	0.29	1.10	15	21	09
	17	23	04	16.80	7	00	13.8	30.588 874	0.29	1.10	15	17	20
	18	23	04	23.01	-6	59	34.1	30.601 691	0.29	1.10	15	13	30
	19	23	04	29.31	6	58	53.9	30.614 306	0.29	1.09	15	09	40
	20	23	04	35.70	6	58	13.1	30.626 716	0.29	1.09	15	05	51
	21	23	04	42.18	6	57	31.8	30.638 918	0.29	1.09	15	02	01
	22	23	04	48.73	6	56	50.1	30.650 910	0.29	1.09	14	58	12
	23	23	04	55.36	6	56	07.8	30.662 687	0.29	1.09	14	54	23
	24	23	05	02.07	-6	55	25.2	30.674 247	0.29	1.09	14	50	34
	25	23	05	08.86	6	54	42.0	30.685 586	0.29	1.09	14	46	44
	26	23	05	15.72	6	53	58.5	30.696 702	0.29	1.09	14	42	55
	27	23	05	22.66	6	53	14.4	30.707 591	0.29	1.09	14	39	06
	28	23	05	29.68	6	52	29.9	30.718 250	0.29	1.09	14	35	18
	29	23	05	36.77	6	51	44.9	30.728 675	0.29	1.09	14	31	29
	30	23	05	43.93	-6	50	59.5	30.738 864	0.29	1.09	14	27	40
	31	23	05	51.16	6	50	13.7	30.748 812	0.29	1.09	14	23	51
Feb.	1	23	05	58.47	6	49	27.5	30.758 518	0.29	1.09	14	20	03
	2	23	06	05.84	6	48	40.9	30.767 979	0.29	1.09	14	16	14
	3	23	06	13.27	6	47	53.9	30.777 190	0.29	1.09	14	12	26
	4	23	06	20.76	6	47	06.6	30.786 150	0.29	1.09	14	08	37
	5	23	06	28.31	-6	46	18.9	30.794 856	0.29	1.09	14	04	49
	6	23	06	35.92	6	45	31.0	30.803 306	0.29	1.09	14	01	01
	7	23	06	43.59	6	44	42.6	30.811 496	0.29	1.09	13	57	12
	8	23	06	51.30	6	43	54.0	30.819 426	0.29	1.09	13	53	24
	9	23	06	59.07	6	43	05.1	30.827 092	0.29	1.09	13	49	36
	10	23	07	06.88	6	42	15.9	30.834 493	0.29	1.09	13	45	48
	11	23	07	14.75	-6	41	26.4	30.841 628	0.29	1.09	13	41	60
	12	23	07	22.66	6	40	36.6	30.848 493	0.29	1.09	13	38	12
	13	23	07	30.62	6	39	46.5	30.855 089	0.29	1.09	13	34	24
	14	23	07	38.63	6	38	56.2	30.861 413	0.29	1.09	13	30	36
	15	23	07	46.68	-6	38	05.6	30.867 464	0.28	1.09	13	26	48

NEPTUNE, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Feb.	15	23	07	46.68	-6	38	05.6	30.867 464	0.28	1.09	13	26	48
	16	23	07	54.77	6	37	14.8	30.873 241	0.28	1.09	13	23	00
	17	23	08	02.90	6	36	23.8	30.878 743	0.28	1.09	13	19	12
	18	23	08	11.06	6	35	32.6	30.883 970	0.28	1.08	13	15	25
	19	23	08	19.25	6	34	41.3	30.888 920	0.28	1.08	13	11	37
	20	23	08	27.47	6	33	49.8	30.893 592	0.28	1.08	13	07	49
	21	23	08	35.71	-6	32	58.2	30.897 985	0.28	1.08	13	04	01
	22	23	08	43.98	6	32	06.4	30.902 099	0.28	1.08	13	00	14
	23	23	08	52.28	6	31	14.5	30.905 932	0.28	1.08	12	56	26
	24	23	09	00.60	6	30	22.4	30.909 483	0.28	1.08	12	52	39
	25	23	09	08.94	6	29	30.3	30.912 751	0.28	1.08	12	48	51
	26	23	09	17.31	6	28	37.9	30.915 735	0.28	1.08	12	45	03
	27	23	09	25.70	-6	27	45.5	30.918 434	0.28	1.08	12	41	16
	28	23	09	34.11	6	26	53.0	30.920 848	0.28	1.08	12	37	28
Mar.	1	23	09	42.54	6	26	00.5	30.922 974	0.28	1.08	12	33	41
	2	23	09	50.98	6	25	07.8	30.924 813	0.28	1.08	12	29	53
	3	23	09	59.42	6	24	15.2	30.926 365	0.28	1.08	12	26	06
	4	23	10	07.88	6	23	22.5	30.927 627	0.28	1.08	12	22	18
	5	23	10	16.34	-6	22	29.9	30.928 602	0.28	1.08	12	18	31
	6	23	10	24.81	6	21	37.3	30.929 287	0.28	1.08	12	14	43
	7	23	10	33.26	6	20	45.0	30.929 684	0.28	1.08	12	10	56
	8	23	10	41.70	6	19	52.2	30.929 792	0.28	1.08	12	07	08
	9	23	10	50.16	6	18	59.5	30.929 611	0.28	1.08	12	03	21
	10	23	10	58.62	6	18	06.9	30.929 142	0.28	1.08	11	59	33
	11	23	11	07.07	-6	17	14.3	30.928 385	0.28	1.08	11	55	46
	12	23	11	15.52	6	16	21.9	30.927 342	0.28	1.08	11	51	58
	13	23	11	23.96	6	15	29.5	30.926 012	0.28	1.08	11	48	11
	14	23	11	32.39	6	14	37.2	30.924 397	0.28	1.08	11	44	23
	15	23	11	40.81	6	13	44.9	30.922 497	0.28	1.08	11	40	36
	16	23	11	49.22	6	12	52.8	30.920 315	0.28	1.08	11	36	48
	17	23	11	57.61	-6	12	00.9	30.917 850	0.28	1.08	11	33	01
	18	23	12	05.98	6	11	09.1	30.915 105	0.28	1.08	11	29	13
	19	23	12	14.32	6	10	17.5	30.912 081	0.28	1.08	11	25	25
	20	23	12	22.64	6	09	26.1	30.908 778	0.28	1.08	11	21	38
	21	23	12	30.93	6	08	34.8	30.905 199	0.28	1.08	11	17	50
	22	23	12	39.19	6	07	43.8	30.901 343	0.28	1.08	11	14	02
	23	23	12	47.43	-6	06	52.9	30.897 213	0.28	1.08	11	10	15
	24	23	12	55.64	6	06	02.3	30.892 810	0.28	1.08	11	06	27
	25	23	13	03.83	6	05	11.8	30.888 134	0.28	1.08	11	02	39
	26	23	13	11.98	6	04	21.5	30.883 186	0.28	1.08	10	58	51
	27	23	13	20.10	6	03	31.5	30.877 968	0.28	1.08	10	55	03
	28	23	13	28.19	6	02	41.7	30.872 482	0.28	1.08	10	51	16
	29	23	13	36.24	-6	01	52.2	30.866 727	0.28	1.09	10	47	28
	30	23	13	44.25	6	01	03.0	30.860 707	0.28	1.09	10	43	40
	31	23	13	52.21	6	00	14.1	30.854 422	0.28	1.09	10	39	52
Apr.	1	23	14	00.13	5	59	25.5	30.847 874	0.29	1.09	10	36	04
	2	23	14	08.00	-5	58	37.2	30.841 065	0.29	1.09	10	32	16

NEPTUNE, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Apr.	1	23	14	00.13	-5	59	25.5	30.847 874	0.29	1.09	10	36	04
	2	23	14	08.00	5	58	37.2	30.841 065	0.29	1.09	10	32	16
	3	23	14	15.83	5	57	49.2	30.833 997	0.29	1.09	10	28	27
	4	23	14	23.60	5	57	01.6	30.826 672	0.29	1.09	10	24	39
	5	23	14	31.32	5	56	14.3	30.819 092	0.29	1.09	10	20	51
	6	23	14	38.99	5	55	27.4	30.811 260	0.29	1.09	10	17	03
	7	23	14	46.61	-5	54	40.8	30.803 178	0.29	1.09	10	13	14
	8	23	14	54.17	5	53	54.6	30.794 849	0.29	1.09	10	09	26
	9	23	15	01.68	5	53	08.8	30.786 274	0.29	1.09	10	05	37
	10	23	15	09.13	5	52	23.3	30.777 458	0.29	1.09	10	01	49
	11	23	15	16.52	5	51	38.2	30.768 403	0.29	1.09	9	58	00
	12	23	15	23.85	5	50	53.6	30.759 112	0.29	1.09	9	54	12
	13	23	15	31.12	-5	50	09.4	30.749 588	0.29	1.09	9	50	23
	14	23	15	38.32	5	49	25.6	30.739 835	0.29	1.09	9	46	34
	15	23	15	45.45	5	48	42.3	30.729 854	0.29	1.09	9	42	45
	16	23	15	52.51	5	47	59.5	30.719 650	0.29	1.09	9	38	56
	17	23	15	59.49	5	47	17.2	30.709 226	0.29	1.09	9	35	07
	18	23	16	06.40	5	46	35.3	30.698 584	0.29	1.09	9	31	18
	19	23	16	13.24	-5	45	54.0	30.687 727	0.29	1.09	9	27	29
	20	23	16	20.01	5	45	13.1	30.676 659	0.29	1.09	9	23	40
	21	23	16	26.70	5	44	32.6	30.665 381	0.29	1.09	9	19	51
	22	23	16	33.33	5	43	52.7	30.653 898	0.29	1.09	9	16	01
	23	23	16	39.87	5	43	13.3	30.642 211	0.29	1.09	9	12	12
	24	23	16	46.34	5	42	34.4	30.630 324	0.29	1.09	9	08	22
	25	23	16	52.73	-5	41	56.0	30.618 240	0.29	1.09	9	04	33
	26	23	16	59.03	5	41	18.2	30.605 961	0.29	1.09	9	00	43
	27	23	17	05.25	5	40	40.9	30.593 491	0.29	1.09	8	56	53
	28	23	17	11.38	5	40	04.2	30.580 833	0.29	1.10	8	53	04
	29	23	17	17.43	5	39	28.1	30.567 991	0.29	1.10	8	49	14
	30	23	17	23.38	5	38	52.6	30.554 967	0.29	1.10	8	45	24
May	1	23	17	29.25	-5	38	17.6	30.541 767	0.29	1.10	8	41	34
	2	23	17	35.02	5	37	43.3	30.528 392	0.29	1.10	8	37	43
	3	23	17	40.70	5	37	09.6	30.514 848	0.29	1.10	8	33	53
	4	23	17	46.29	5	36	36.4	30.501 137	0.29	1.10	8	30	03
	5	23	17	51.78	5	36	03.9	30.487 264	0.29	1.10	8	26	12
	6	23	17	57.19	5	35	32.0	30.473 234	0.29	1.10	8	22	22
	7	23	18	02.50	-5	35	00.6	30.459 049	0.29	1.10	8	18	31
	8	23	18	07.71	5	34	29.9	30.444 715	0.29	1.10	8	14	40
	9	23	18	12.82	5	33	59.9	30.430 236	0.29	1.10	8	10	49
	10	23	18	17.84	5	33	30.5	30.415 616	0.29	1.10	8	06	58
	11	23	18	22.75	5	33	01.8	30.400 860	0.29	1.10	8	03	07
	12	23	18	27.56	5	32	33.8	30.385 971	0.29	1.10	7	59	16
	13	23	18	32.26	-5	32	06.4	30.370 955	0.29	1.10	7	55	25
	14	23	18	36.86	5	31	39.8	30.355 816	0.29	1.10	7	51	34
	15	23	18	41.34	5	31	13.8	30.340 558	0.29	1.10	7	47	42
	16	23	18	45.73	5	30	48.5	30.325 185	0.29	1.10	7	43	50
	17	23	18	50.00	-5	30	23.9	30.309 701	0.29	1.10	7	39	59

NEPTUNE, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
May	17	23	18	50.00	-5	30	23.9	30.309 701	0.29	1.10	7	39	59
	18	23	18	54.18	5	30	00.0	30.294 111	0.29	1.11	7	36	07
	19	23	18	58.25	5	29	36.8	30.278 417	0.29	1.11	7	32	15
	20	23	19	02.21	5	29	14.2	30.262 625	0.29	1.11	7	28	23
	21	23	19	06.06	5	28	52.4	30.246 737	0.29	1.11	7	24	31
	22	23	19	09.81	5	28	31.2	30.230 759	0.29	1.11	7	20	39
	23	23	19	13.44	-5	28	10.8	30.214 694	0.29	1.11	7	16	46
	24	23	19	16.97	5	27	51.1	30.198 546	0.29	1.11	7	12	54
	25	23	19	20.37	5	27	32.1	30.182 319	0.29	1.11	7	09	01
	26	23	19	23.67	5	27	13.9	30.166 018	0.29	1.11	7	05	09
	27	23	19	26.84	5	26	56.5	30.149 648	0.29	1.11	7	01	16
	28	23	19	29.90	5	26	39.8	30.133 212	0.29	1.11	6	57	23
	29	23	19	32.84	-5	26	23.8	30.116 715	0.29	1.11	6	53	30
	30	23	19	35.67	5	26	08.6	30.100 162	0.29	1.11	6	49	37
	31	23	19	38.38	5	25	54.1	30.083 557	0.29	1.11	6	45	44
June	1	23	19	40.98	5	25	40.4	30.066 905	0.29	1.11	6	41	50
	2	23	19	43.46	5	25	27.4	30.050 211	0.29	1.11	6	37	57
	3	23	19	45.82	5	25	15.1	30.033 481	0.29	1.11	6	34	03
	4	23	19	48.07	-5	25	03.6	30.016 717	0.29	1.12	6	30	10
	5	23	19	50.20	5	24	52.8	29.999 927	0.29	1.12	6	26	16
	6	23	19	52.22	5	24	42.8	29.983 115	0.29	1.12	6	22	22
	7	23	19	54.11	5	24	33.6	29.966 286	0.29	1.12	6	18	28
	8	23	19	55.88	5	24	25.2	29.949 445	0.29	1.12	6	14	34
	9	23	19	57.52	5	24	17.5	29.932 597	0.29	1.12	6	10	39
	10	23	19	59.04	-5	24	10.7	29.915 747	0.29	1.12	6	06	45
	11	23	20	00.44	5	24	04.6	29.898 899	0.29	1.12	6	02	50
	12	23	20	01.72	5	23	59.3	29.882 059	0.29	1.12	5	58	56
	13	23	20	02.87	5	23	54.8	29.865 231	0.29	1.12	5	55	01
	14	23	20	03.91	5	23	51.0	29.848 420	0.29	1.12	5	51	06
	15	23	20	04.84	5	23	48.0	29.831 629	0.29	1.12	5	47	11
	16	23	20	05.64	-5	23	45.7	29.814 863	0.29	1.12	5	43	16
	17	23	20	06.33	5	23	44.1	29.798 126	0.29	1.12	5	39	20
	18	23	20	06.89	5	23	43.4	29.781 424	0.30	1.12	5	35	25
	19	23	20	07.34	5	23	43.4	29.764 759	0.30	1.12	5	31	30
	20	23	20	07.67	5	23	44.1	29.748 137	0.30	1.13	5	27	34
	21	23	20	07.87	5	23	45.6	29.731 562	0.30	1.13	5	23	38
	22	23	20	07.95	-5	23	48.0	29.715 038	0.30	1.13	5	19	42
	23	23	20	07.91	5	23	51.0	29.698 571	0.30	1.13	5	15	46
	24	23	20	07.75	5	23	54.9	29.682 164	0.30	1.13	5	11	50
	25	23	20	07.47	5	23	59.5	29.665 821	0.30	1.13	5	07	54
	26	23	20	07.06	5	24	04.9	29.649 549	0.30	1.13	5	03	58
	27	23	20	06.54	5	24	11.0	29.633 351	0.30	1.13	5	00	01
	28	23	20	05.90	-5	24	17.8	29.617 233	0.30	1.13	4	56	05
	29	23	20	05.14	5	24	25.4	29.601 198	0.30	1.13	4	52	08
	30	23	20	04.27	5	24	33.7	29.585 252	0.30	1.13	4	48	11
July	1	23	20	03.28	5	24	42.7	29.569 401	0.30	1.13	4	44	14
	2	23	20	02.18	-5	24	52.5	29.553 647	0.30	1.13	4	40	17

NEPTUNE, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
July	1	23	20	03.28	-5	24	42.7	29.569 401	0.30	1.13	4	44	14
	2	23	20	02.18	5	24	52.5	29.553 647	0.30	1.13	4	40	17
	3	23	20	00.96	5	25	03.0	29.537 998	0.30	1.13	4	36	20
	4	23	19	59.62	5	25	14.2	29.522 457	0.30	1.13	4	32	23
	5	23	19	58.17	5	25	26.2	29.507 029	0.30	1.13	4	28	25
	6	23	19	56.59	5	25	38.9	29.491 720	0.30	1.14	4	24	28
	7	23	19	54.90	-5	25	52.3	29.476 533	0.30	1.14	4	20	30
	8	23	19	53.09	5	26	06.5	29.461 475	0.30	1.14	4	16	33
	9	23	19	51.17	5	26	21.4	29.446 548	0.30	1.14	4	12	35
	10	23	19	49.14	5	26	36.9	29.431 756	0.30	1.14	4	08	37
	11	23	19	47.00	5	26	53.1	29.417 105	0.30	1.14	4	04	39
	12	23	19	44.75	5	27	10.0	29.402 599	0.30	1.14	4	00	41
	13	23	19	42.39	-5	27	27.6	29.388 240	0.30	1.14	3	56	42
	14	23	19	39.93	5	27	45.8	29.374 033	0.30	1.14	3	52	44
	15	23	19	37.37	5	28	04.6	29.359 981	0.30	1.14	3	48	46
	16	23	19	34.70	5	28	24.1	29.346 089	0.30	1.14	3	44	47
	17	23	19	31.92	5	28	44.3	29.332 361	0.30	1.14	3	40	48
	18	23	19	29.04	5	29	05.1	29.318 799	0.30	1.14	3	36	49
	19	23	19	26.05	-5	29	26.6	29.305 409	0.30	1.14	3	32	51
	20	23	19	22.96	5	29	48.7	29.292 193	0.30	1.14	3	28	52
	21	23	19	19.76	5	30	11.4	29.279 156	0.30	1.14	3	24	52
	22	23	19	16.47	5	30	34.8	29.266 301	0.30	1.14	3	20	53
	23	23	19	13.07	5	30	58.7	29.253 632	0.30	1.14	3	16	54
	24	23	19	09.58	5	31	23.3	29.241 154	0.30	1.15	3	12	55
	25	23	19	05.99	-5	31	48.4	29.228 869	0.30	1.15	3	08	55
	26	23	19	02.31	5	32	14.1	29.216 783	0.30	1.15	3	04	55
	27	23	18	58.53	5	32	40.3	29.204 898	0.30	1.15	3	00	56
	28	23	18	54.67	5	33	07.0	29.193 219	0.30	1.15	2	56	56
	29	23	18	50.72	5	33	34.4	29.181 750	0.30	1.15	2	52	56
	30	23	18	46.68	5	34	02.2	29.170 494	0.30	1.15	2	48	56
	31	23	18	42.56	-5	34	30.6	29.159 455	0.30	1.15	2	44	56
Aug.	1	23	18	38.34	5	34	59.5	29.148 638	0.30	1.15	2	40	56
	2	23	18	34.04	5	35	28.9	29.138 046	0.30	1.15	2	36	56
	3	23	18	29.65	5	35	58.8	29.127 683	0.30	1.15	2	32	56
	4	23	18	25.17	5	36	29.3	29.117 551	0.30	1.15	2	28	55
	5	23	18	20.61	5	37	00.2	29.107 655	0.30	1.15	2	24	55
	6	23	18	15.98	-5	37	31.6	29.097 996	0.30	1.15	2	20	54
	7	23	18	11.27	5	38	03.5	29.088 579	0.30	1.15	2	16	54
	8	23	18	06.49	5	38	35.7	29.079 405	0.30	1.15	2	12	53
	9	23	18	01.64	5	39	08.3	29.070 477	0.30	1.15	2	08	52
	10	23	17	56.72	5	39	41.4	29.061 798	0.30	1.15	2	04	51
	11	23	17	51.73	5	40	14.8	29.053 370	0.30	1.15	2	00	51
	12	23	17	46.68	-5	40	48.6	29.045 196	0.30	1.15	1	56	50
	13	23	17	41.56	5	41	22.8	29.037 277	0.30	1.15	1	52	49
	14	23	17	36.38	5	41	57.4	29.029 616	0.30	1.15	1	48	48
	15	23	17	31.14	5	42	32.4	29.022 215	0.30	1.15	1	44	46
	16	23	17	25.83	-5	43	07.6	29.015 077	0.30	1.15	1	40	45

NEPTUNE, 2019
RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Aug.	16	23	17	25.83	-5	43	07.6	29.015 077	0.30	1.15	1	40	45
	17	23	17	20.47	5	43	43.3	29.008 203	0.30	1.15	1	36	44
	18	23	17	15.04	5	44	19.2	29.001 596	0.30	1.15	1	32	43
	19	23	17	09.57	5	44	55.5	28.995 259	0.30	1.16	1	28	41
	20	23	17	04.04	5	45	32.0	28.989 192	0.30	1.16	1	24	40
	21	23	16	58.46	5	46	08.8	28.983 399	0.30	1.16	1	20	39
	22	23	16	52.83	-5	46	45.8	28.977 882	0.30	1.16	1	16	37
	23	23	16	47.16	5	47	23.1	28.972 642	0.30	1.16	1	12	35
	24	23	16	41.45	5	48	00.6	28.967 681	0.30	1.16	1	08	34
	25	23	16	35.70	5	48	38.3	28.963 003	0.30	1.16	1	04	32
	26	23	16	29.92	5	49	16.2	28.958 608	0.30	1.16	1	00	31
	27	23	16	24.09	5	49	54.3	28.954 498	0.30	1.16	0	56	29
	28	23	16	18.24	-5	50	32.5	28.950 676	0.30	1.16	0	52	27
	29	23	16	12.34	5	51	11.0	28.947 144	0.30	1.16	0	48	25
	30	23	16	06.41	5	51	49.6	28.943 902	0.30	1.16	0	44	24
	31	23	16	00.45	5	52	28.4	28.940 953	0.30	1.16	0	40	22
Sept.	1	23	15	54.47	5	53	07.3	28.938 297	0.30	1.16	0	36	20
	2	23	15	48.45	5	53	46.3	28.935 936	0.30	1.16	0	32	18
	3	23	15	42.42	-5	54	25.4	28.933 870	0.30	1.16	0	28	16
	4	23	15	36.37	5	55	04.5	28.932 099	0.30	1.16	0	24	14
	5	23	15	30.31	5	55	43.7	28.930 626	0.30	1.16	0	20	12
	6	23	15	24.24	5	56	22.8	28.929 448	0.30	1.16	0	16	10
	7	23	15	18.16	5	57	02.0	28.928 568	0.30	1.16	0	12	08
	8	23	15	12.08	5	57	41.2	28.927 984	0.30	1.16	0	08	06
	9	23	15	05.98	-5	58	20.4	28.927 697	0.30	1.16	0	04	04
	10	23	14	59.88	5	58	59.6	28.927 708	0.30	1.16	0	00	02
	11	23	14	53.78	5	59	38.8	28.928 015	0.30	1.16	23	51	58
	12	23	14	47.67	6	00	17.9	28.928 619	0.30	1.16	23	47	56
	13	23	14	41.57	6	00	57.0	28.929 520	0.30	1.16	23	43	54
	14	23	14	35.47	6	01	36.0	28.930 718	0.30	1.16	23	39	53
	15	23	14	29.37	-6	02	15.0	28.932 212	0.30	1.16	23	35	51
	16	23	14	23.29	6	02	53.8	28.934 002	0.30	1.16	23	31	49
	17	23	14	17.21	6	03	32.5	28.936 089	0.30	1.16	23	27	47
	18	23	14	11.15	6	04	11.0	28.938 471	0.30	1.16	23	23	45
	19	23	14	05.11	6	04	49.4	28.941 149	0.30	1.16	23	19	43
	20	23	13	59.09	6	05	27.6	28.944 122	0.30	1.16	23	15	41
	21	23	13	53.09	-6	06	05.6	28.947 389	0.30	1.16	23	11	39
	22	23	13	47.12	6	06	43.4	28.950 951	0.30	1.16	23	07	37
	23	23	13	41.18	6	07	21.0	28.954 807	0.30	1.16	23	03	36
	24	23	13	35.26	6	07	58.3	28.958 956	0.30	1.16	22	59	34
	25	23	13	29.38	6	08	35.5	28.963 397	0.30	1.16	22	55	32
	26	23	13	23.52	6	09	12.4	28.968 130	0.30	1.16	22	51	30
	27	23	13	17.69	-6	09	49.0	28.973 153	0.30	1.16	22	47	29
	28	23	13	11.90	6	10	25.4	28.978 466	0.30	1.16	22	43	27
	29	23	13	06.15	6	11	01.5	28.984 066	0.30	1.16	22	39	25
	30	23	13	00.44	6	11	37.3	28.989 953	0.30	1.16	22	35	24
Oct.	1	23	12	54.77	-6	12	12.8	28.996 125	0.30	1.16	22	31	22

NEPTUNE, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Oct.	1	23	12	54.77	-6	12	12.8	28.996 125	0.30	1.16	22	31	22
	2	23	12	49.16	6	12	47.8	29.002 578	0.30	1.16	22	27	21
	3	23	12	43.60	6	13	22.5	29.009 312	0.30	1.16	22	23	20
	4	23	12	38.10	6	13	56.8	29.016 323	0.30	1.15	22	19	18
	5	23	12	32.65	6	14	30.8	29.023 610	0.30	1.15	22	15	17
	6	23	12	27.25	6	15	04.3	29.031 169	0.30	1.15	22	11	16
	7	23	12	21.92	-6	15	37.4	29.038 999	0.30	1.15	22	07	15
	8	23	12	16.64	6	16	10.1	29.047 097	0.30	1.15	22	03	14
	9	23	12	11.42	6	16	42.4	29.055 459	0.30	1.15	21	59	12
	10	23	12	06.27	6	17	14.3	29.064 085	0.30	1.15	21	55	12
	11	23	12	01.18	6	17	45.7	29.072 971	0.30	1.15	21	51	11
	12	23	11	56.16	6	18	16.7	29.082 114	0.30	1.15	21	47	10
	13	23	11	51.21	-6	18	47.1	29.091 511	0.30	1.15	21	43	09
	14	23	11	46.33	6	19	17.1	29.101 161	0.30	1.15	21	39	08
	15	23	11	41.52	6	19	46.5	29.111 060	0.30	1.15	21	35	08
	16	23	11	36.80	6	20	15.5	29.121 206	0.30	1.15	21	31	07
	17	23	11	32.15	6	20	43.8	29.131 595	0.30	1.15	21	27	07
	18	23	11	27.59	6	21	11.6	29.142 225	0.30	1.15	21	23	06
	19	23	11	23.11	-6	21	38.9	29.153 094	0.30	1.15	21	19	06
	20	23	11	18.71	6	22	05.6	29.164 197	0.30	1.15	21	15	06
	21	23	11	14.40	6	22	31.7	29.175 533	0.30	1.15	21	11	06
	22	23	11	10.18	6	22	57.2	29.187 097	0.30	1.15	21	07	06
	23	23	11	06.04	6	23	22.2	29.198 888	0.30	1.15	21	03	06
	24	23	11	02.00	6	23	46.6	29.210 901	0.30	1.15	20	59	06
	25	23	10	58.04	-6	24	10.4	29.223 134	0.30	1.15	20	55	06
	26	23	10	54.17	6	24	33.5	29.235 582	0.30	1.15	20	51	06
	27	23	10	50.40	6	24	56.1	29.248 241	0.30	1.15	20	47	07
	28	23	10	46.73	6	25	18.0	29.261 108	0.30	1.15	20	43	07
	29	23	10	43.16	6	25	39.1	29.274 179	0.30	1.14	20	39	08
	30	23	10	39.70	6	25	59.7	29.287 448	0.30	1.14	20	35	09
	31	23	10	36.34	-6	26	19.5	29.300 912	0.30	1.14	20	31	10
Nov.	1	23	10	33.09	6	26	38.6	29.314 566	0.30	1.14	20	27	11
	2	23	10	29.94	6	26	57.0	29.328 405	0.30	1.14	20	23	12
	3	23	10	26.91	6	27	14.8	29.342 425	0.30	1.14	20	19	13
	4	23	10	23.97	6	27	31.8	29.356 621	0.30	1.14	20	15	14
	5	23	10	21.15	6	27	48.2	29.370 989	0.30	1.14	20	11	15
	6	23	10	18.43	-6	28	03.8	29.385 523	0.30	1.14	20	07	17
	7	23	10	15.83	6	28	18.8	29.400 220	0.30	1.14	20	03	18
	8	23	10	13.33	6	28	33.0	29.415 075	0.30	1.14	19	59	20
	9	23	10	10.95	6	28	46.4	29.430 084	0.30	1.14	19	55	22
	10	23	10	08.68	6	28	59.2	29.445 240	0.30	1.14	19	51	24
	11	23	10	06.53	6	29	11.1	29.460 542	0.30	1.14	19	47	26
	12	23	10	04.50	-6	29	22.3	29.475 982	0.30	1.14	19	43	28
	13	23	10	02.59	6	29	32.8	29.491 558	0.30	1.14	19	39	30
	14	23	10	00.80	6	29	42.4	29.507 265	0.30	1.14	19	35	33
	15	23	09	59.13	6	29	51.3	29.523 097	0.30	1.14	19	31	35
	16	23	09	57.59	-6	29	59.4	29.539 051	0.30	1.13	19	27	38

NEPTUNE, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Apparent Declination			True Distance from the Earth	Hor. Parallax	Semi Diameter	Ephemeris Transit		
		h	m	s	°	'	"		"	"	h	m	s
Nov.	16	23	09	57.59	-6	29	59.4	29.539 051	0.30	1.13	19	27	38
	17	23	09	56.16	6	30	06.7	29.555 122	0.30	1.13	19	23	41
	18	23	09	54.86	6	30	13.2	29.571 306	0.30	1.13	19	19	44
	19	23	09	53.68	6	30	19.0	29.587 597	0.30	1.13	19	15	47
	20	23	09	52.61	6	30	24.0	29.603 991	0.30	1.13	19	11	50
	21	23	09	51.67	6	30	28.3	29.620 483	0.30	1.13	19	07	53
	22	23	09	50.85	-6	30	31.7	29.637 069	0.30	1.13	19	03	56
	23	23	09	50.16	6	30	34.4	29.653 742	0.30	1.13	18	59	60
	24	23	09	49.59	6	30	36.3	29.670 498	0.30	1.13	18	56	04
	25	23	09	49.15	6	30	37.3	29.687 331	0.30	1.13	18	52	07
	26	23	09	48.85	6	30	37.5	29.704 236	0.30	1.13	18	48	11
	27	23	09	48.67	6	30	36.8	29.721 207	0.30	1.13	18	44	15
	28	23	09	48.63	-6	30	35.4	29.738 238	0.30	1.13	18	40	19
	29	23	09	48.71	6	30	33.1	29.755 324	0.30	1.13	18	36	24
	30	23	09	48.92	6	30	30.0	29.772 459	0.30	1.13	18	32	28
Dec.	1	23	09	49.26	6	30	26.1	29.789 638	0.30	1.13	18	28	33
	2	23	09	49.73	6	30	21.5	29.806 855	0.30	1.12	18	24	37
	3	23	09	50.32	6	30	16.0	29.824 104	0.30	1.12	18	20	42
	4	23	09	51.05	-6	30	09.7	29.841 380	0.29	1.12	18	16	47
	5	23	09	51.89	6	30	02.6	29.858 678	0.29	1.12	18	12	52
	6	23	09	52.87	6	29	54.8	29.875 993	0.29	1.12	18	08	57
	7	23	09	53.97	6	29	46.1	29.893 319	0.29	1.12	18	05	02
	8	23	09	55.20	6	29	36.6	29.910 650	0.29	1.12	18	01	08
	9	23	09	56.56	6	29	26.2	29.927 983	0.29	1.12	17	57	13
	10	23	09	58.06	-6	29	15.1	29.945 311	0.29	1.12	17	53	19
	11	23	09	59.68	6	29	03.1	29.962 630	0.29	1.12	17	49	25
	12	23	10	01.43	6	28	50.4	29.979 935	0.29	1.12	17	45	31
	13	23	10	03.31	6	28	36.8	29.997 221	0.29	1.12	17	41	37
	14	23	10	05.32	6	28	22.4	30.014 483	0.29	1.12	17	37	43
	15	23	10	07.46	6	28	07.3	30.031 715	0.29	1.12	17	33	49
	16	23	10	09.71	-6	27	51.4	30.048 914	0.29	1.12	17	29	56
	17	23	10	12.10	6	27	34.7	30.066 075	0.29	1.11	17	26	02
	18	23	10	14.60	6	27	17.3	30.083 191	0.29	1.11	17	22	09
	19	23	10	17.22	6	26	59.1	30.100 259	0.29	1.11	17	18	16
	20	23	10	19.97	6	26	40.2	30.117 273	0.29	1.11	17	14	23
	21	23	10	22.84	6	26	20.4	30.134 228	0.29	1.11	17	10	30
	22	23	10	25.84	-6	25	59.9	30.151 118	0.29	1.11	17	06	37
	23	23	10	28.96	6	25	38.6	30.167 938	0.29	1.11	17	02	44
	24	23	10	32.21	6	25	16.5	30.184 683	0.29	1.11	16	58	51
	25	23	10	35.59	6	24	53.7	30.201 347	0.29	1.11	16	54	59
	26	23	10	39.08	6	24	30.1	30.217 925	0.29	1.11	16	51	07
	27	23	10	42.70	6	24	05.7	30.234 411	0.29	1.11	16	47	14
	28	23	10	46.43	-6	23	40.7	30.250 800	0.29	1.11	16	43	22
	29	23	10	50.28	6	23	14.9	30.267 088	0.29	1.11	16	39	30
	30	23	10	54.25	6	22	48.4	30.283 268	0.29	1.11	16	35	38
	31	23	10	58.33	6	22	21.2	30.299 337	0.29	1.11	16	31	47
	32	23	11	02.52	-6	21	53.3	30.315 289	0.29	1.11	16	27	55

PLUTO, 2019

HELIOCENTRIC POSITIONS FOR 0^h TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector	Date		Heliocentric Longitude ° ' "	Heliocentric Latitude ° ' "	Radius Vector
Jan.	1	290 54 14.8	-0 06 26.1	33.711 77	July	5	291 50 38.7	-0 23 39.6	33.832 48
	6	290 55 46.5	0 06 54.2	33.715 03		10	291 52 09.8	0 24 07.5	33.835 75
	11	290 57 18.3	0 07 22.2	33.718 28		15	291 53 41.0	0 24 35.3	33.839 02
	16	290 58 50.0	0 07 50.3	33.721 54		20	291 55 12.1	0 25 03.1	33.842 29
	21	291 00 21.7	0 08 18.3	33.724 79		25	291 56 43.2	0 25 30.9	33.845 56
	26	291 01 53.3	0 08 46.3	33.728 05		30	291 58 14.3	0 25 58.7	33.848 83
	31	291 03 25.0	-0 09 14.3	33.731 31	Aug.	4	291 59 45.3	-0 26 26.5	33.852 11
Feb.	5	291 04 56.7	0 09 42.3	33.734 56		9	292 01 16.4	0 26 54.3	33.855 38
	10	291 06 28.3	0 10 10.2	33.737 82		14	292 02 47.4	0 27 22.1	33.858 65
	15	291 07 60.0	0 10 38.3	33.741 08		19	292 04 18.4	0 27 49.9	33.861 93
	20	291 09 31.5	0 11 06.2	33.744 34		24	292 05 49.4	0 28 17.7	33.865 20
	25	291 11 03.1	0 11 34.2	33.747 60		29	292 07 20.4	0 28 45.4	33.868 47
Mar.	2	291 12 34.7	-0 12 02.2	33.750 86	Sept.	3	292 08 51.4	-0 29 13.2	33.871 75
	7	291 14 06.3	0 12 30.2	33.754 12		8	292 10 22.3	0 29 40.9	33.875 02
	12	291 15 37.8	0 12 58.1	33.757 38		13	292 11 53.2	0 30 08.7	33.878 30
	17	291 17 09.3	0 13 26.1	33.760 64		18	292 13 24.1	0 30 36.4	33.881 58
	22	291 18 40.8	0 13 54.0	33.763 90		23	292 14 55.0	0 31 04.2	33.884 85
	27	291 20 12.3	0 14 22.0	33.767 16		28	292 16 25.9	0 31 31.9	33.888 13
Apr.	1	291 21 43.8	-0 14 49.9	33.770 42	Oct.	3	292 17 56.8	-0 31 59.6	33.891 41
	6	291 23 15.3	0 15 17.8	33.773 68		8	292 19 27.6	0 32 27.4	33.894 68
	11	291 24 46.7	0 15 45.7	33.776 95		13	292 20 58.4	0 32 55.1	33.897 96
	16	291 26 18.1	0 16 13.7	33.780 21		18	292 22 29.3	0 33 22.8	33.901 24
	21	291 27 49.5	0 16 41.6	33.783 47		23	292 24 00.1	0 33 50.5	33.904 52
	26	291 29 20.9	0 17 09.5	33.786 74		28	292 25 30.8	0 34 18.2	33.907 80
May	1	291 30 52.3	-0 17 37.4	33.790 00	Nov.	2	292 27 01.6	-0 34 45.9	33.911 08
	6	291 32 23.7	0 18 05.3	33.793 27		7	292 28 32.4	0 35 13.6	33.914 36
	11	291 33 55.0	0 18 33.2	33.796 53		12	292 30 03.1	0 35 41.3	33.917 64
	16	291 35 26.4	0 19 01.1	33.799 80		17	292 31 33.8	0 36 09.0	33.920 92
	21	291 36 57.7	0 19 29.0	33.803 07		22	292 33 04.5	0 36 36.6	33.924 20
	26	291 38 29.0	0 19 56.8	33.806 33		27	292 34 35.2	0 37 04.3	33.927 48
	31	291 40 00.2	-0 20 24.7	33.809 60	Dec.	2	292 36 05.8	-0 37 32.0	33.930 76
June	5	291 41 31.5	0 20 52.6	33.812 87		7	292 37 36.5	0 37 59.6	33.934 04
	10	291 43 02.7	0 21 20.4	33.816 13		12	292 39 07.1	0 38 27.3	33.937 32
	15	291 44 34.0	0 21 48.3	33.819 40		17	292 40 37.7	0 38 54.9	33.940 60
	20	291 46 05.2	0 22 16.1	33.822 67		22	292 42 08.3	0 39 22.5	33.943 89
	25	291 47 36.4	0 22 44.0	33.825 94		27	292 43 38.9	0 39 50.2	33.947 17
	30	291 49 07.5	-0 23 11.8	33.829 21		32	292 45 09.5	-0 40 17.8	33.950 45
July	5	291 50 38.7	-0 23 39.6	33.832 48		37	292 46 40.0	-0 40 45.4	33.953 74

N.B: Pluto is now classified as a dwarf planet as per resolution of IAU

PLUTO, 2019

GEOCENTRIC LONGITUDE AND LATITUDE FOR 0^h TERRESTRIAL TIME

Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"	Date		Apparent Geocentric Longitude °	'	"	Apparent Geocentric Latitude °	'	"
Jan.	1	290	35	35.9	-0	06	14.3	July	5	292	07	31.1	-0	24	21.9
	6	290	45	40.6	0	06	41.4		10	292	00	17.4	0	24	51.1
	11	290	55	49.9	0	07	08.8		15	291	53	00.6	0	25	19.9
	16	291	05	57.1	0	07	35.9		20	291	45	44.1	0	25	48.4
	21	291	16	02.8	0	08	03.2		25	291	38	31.2	0	26	16.5
	26	291	26	01.0	0	08	30.7		30	291	31	26.9	0	26	44.2
	31	291	35	48.9	-0	08	58.3	Aug.	4	291	24	34.8	-0	27	11.6
Feb.	5	291	45	23.3	0	09	26.1		9	291	17	58.3	0	27	38.5
	10	291	54	39.7	0	09	54.0		14	291	11	42.4	0	28	05.1
	15	292	03	35.5	0	10	22.1		19	291	05	49.0	0	28	31.3
	20	292	12	07.7	0	10	50.3		24	291	00	22.0	0	28	57.0
	25	292	20	12.5	0	11	18.8		29	290	55	25.3	0	29	22.4
Mar.	2	292	27	48.5	-0	11	47.4	Sept.	3	290	51	00.3	-0	29	47.4
	7	292	34	51.9	0	12	16.3		8	290	47	11.2	0	30	12.0
	12	292	41	20.2	0	12	45.4		13	290	43	59.6	0	30	36.3
	17	292	47	12.2	0	13	14.6		18	290	41	26.8	0	31	00.3
	22	292	52	24.8	0	13	44.1		23	290	39	35.6	0	31	24.0
	27	292	56	57.4	0	14	13.8		28	290	38	26.8	0	31	47.4
Apr.	1	293	00	48.5	-0	14	43.6	Oct.	3	290	38	01.5	-0	32	10.6
	6	293	03	55.9	0	15	13.7		8	290	38	21.3	0	32	33.6
	11	293	06	19.7	0	15	43.9		13	290	39	25.1	0	32	56.4
	16	293	07	59.4	0	16	14.2		18	290	41	13.6	0	33	19.1
	21	293	08	54.1	0	16	44.7		23	290	43	47.1	0	33	41.6
	26	293	09	05.3	0	17	15.3		28	290	47	03.8	0	34	04.2
May	1	293	08	32.2	-0	17	46.1	Nov.	2	290	51	04.3	-0	34	26.7
	6	293	07	15.5	0	18	16.9		7	290	55	46.3	0	34	49.3
	11	293	05	17.4	0	18	47.7		12	291	01	08.0	0	35	11.9
	16	293	02	38.0	0	19	18.5		17	291	07	08.6	0	35	34.6
	21	292	59	20.2	0	19	49.4		22	291	13	45.2	0	35	57.5
	26	292	55	25.8	0	20	20.3		27	291	20	55.9	0	36	20.5
	31	292	50	56.1	-0	20	51.0	Dec.	2	291	28	38.8	-0	36	43.8
June	5	292	45	54.7	0	21	21.7		7	291	36	49.6	0	37	07.4
	10	292	40	24.3	0	21	52.2		12	291	45	26.4	0	37	31.2
	15	292	34	27.4	0	22	22.6		17	291	54	26.2	0	37	55.4
	20	292	28	08.8	0	22	52.8		22	292	03	44.8	0	38	20.0
	25	292	21	30.5	0	23	22.8		27	292	13	20.4	0	38	44.9
	30	292	14	36.4	-0	23	52.5		32	292	23	08.4	-0	39	10.3
July	5	292	07	31.1	-0	24	21.9		37	292	33	04.9	-0	39	36.2

N.B : Pluto is now classified as a dwarf planet as per resolution of I.A.U

PLUTO, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Red. To Astrom. (J 2000.0)	Apparent Declination			Red. To Astrom. (J 2000.0)	True Distance from the Earth	Hor. Parallax	Ephemeris Transit	
		h	m	s	s	°	'	"	"		"	h	m
Jan.	1	19	29	08.92	+65.34	-21	57	37.7	-142.60	34.678 657	0.25	12	46
	6	19	29	52.18	65.38	21	56	32.9	143.82	34.693 837	0.25	12	27
	11	19	30	35.76	65.48	21	55	27.3	144.70	34.701 664	0.25	12	08
	16	19	31	19.18	65.42	21	54	20.7	145.85	34.702 122	0.25	11	49
	21	19	32	02.48	65.51	21	53	13.9	147.11	34.695 273	0.25	11	30
	26	19	32	45.23	65.56	21	52	08.0	148.04	34.681 219	0.25	11	11
	31	19	33	27.25	+65.62	-21	51	02.8	-149.27	34.660 060	0.25	10	52
Feb.	5	19	34	08.31	65.72	21	49	59.5	150.36	34.631 947	0.25	10	33
	10	19	34	48.07	65.78	21	48	58.7	151.30	34.597 113	0.25	10	14
	15	19	35	26.37	65.86	21	48	00.4	152.51	34.555 873	0.25	9	55
	20	19	36	02.99	65.99	21	47	05.9	153.49	34.508 594	0.25	9	36
	25	19	36	37.67	66.07	21	46	15.3	154.48	34.455 647	0.26	9	17
Mar.	2	19	37	10.30	+66.20	-21	45	29.2	-155.60	34.397 404	0.26	8	58
	7	19	37	40.62	66.31	21	44	48.5	156.42	34.334 301	0.26	8	39
	12	19	38	08.45	66.41	21	44	13.1	157.37	34.266 843	0.26	8	19
	17	19	38	33.71	66.56	21	43	43.7	158.39	34.195 584	0.26	8	00
	22	19	38	56.19	66.69	21	43	21.0	159.07	34.121 093	0.26	7	41
	27	19	39	15.83	66.83	21	43	04.7	160.04	34.043 903	0.26	7	22
Apr.	1	19	39	32.54	+66.99	-21	42	55.6	-160.77	33.964 566	0.26	7	02
	6	19	39	46.16	67.11	21	42	53.9	161.36	33.883 684	0.26	6	43
	11	19	39	56.69	67.27	21	42	59.3	162.17	33.801 897	0.26	6	23
	16	19	40	04.11	67.45	21	43	12.6	162.67	33.719 858	0.26	6	04
	21	19	40	08.35	67.58	21	43	33.4	163.18	33.638 177	0.26	5	44
	26	19	40	09.51	67.77	21	44	01.5	163.77	33.557 427	0.26	5	24
May	1	19	40	07.54	+67.93	-21	44	37.5	-164.00	33.478 197	0.26	5	05
	6	19	40	02.49	68.08	21	45	20.6	164.35	33.401 104	0.26	4	45
	11	19	39	54.50	68.28	21	46	10.8	164.66	33.326 765	0.26	4	25
	16	19	39	43.59	68.43	21	47	08.0	164.63	33.255 761	0.26	4	05
	21	19	39	29.95	68.60	21	48	11.4	164.85	33.188 596	0.26	3	45
	26	19	39	13.73	68.78	21	49	21.0	164.77	33.125 745	0.27	3	26
	31	19	38	55.00	+68.91	-21	50	36.3	-164.54	33.067 691	0.27	3	06
June	5	19	38	34.02	69.08	21	51	56.4	164.52	33.014 911	0.27	2	46
	10	19	38	10.97	69.25	21	53	21.3	164.10	32.967 849	0.27	2	26
	15	19	37	46.04	69.37	21	54	50.1	163.75	32.926 858	0.27	2	05
	20	19	37	19.56	69.53	21	56	22.0	163.40	32.892 220	0.27	1	45
	25	19	36	51.67	69.65	21	57	56.9	162.72	32.864 199	0.27	1	25
	30	19	36	22.64	+69.75	-21	59	33.6	-162.18	32.843 045	0.27	1	05
July	5	19	35	52.81	69.89	22	01	11.5	161.60	32.828 979	0.27	0	45
	10	19	35	22.37	69.97	22	02	50.4	160.72	32.822 143	0.27	0	25
	15	19	34	51.69	70.06	22	04	28.8	160.12	32.822 577	0.27	0	05
	20	19	34	21.02	70.15	22	06	06.8	159.24	32.830 276	0.27	23	40
	25	19	33	50.58	70.18	22	07	43.4	158.32	32.845 217	0.27	23	20
	30	19	33	20.74	+70.24	-22	09	17.8	-157.63	32.867 353	0.27	23	00
Aug.	4	19	32	51.76	70.29	22	10	49.8	156.60	32.896 582	0.27	22	40
	9	19	32	23.87	70.29	22	12	18.5	155.79	32.932 701	0.27	22	20
	14	19	31	57.43	70.33	22	13	43.4	155.00	32.975 430	0.27	22	00
	19	19	31	32.58	+70.31	-22	15	04.2	-154.00	33.024 476	0.27	21	40

N.B: Pluto is now classified as a dwarf planet as per resolution of I A U

PLUTO, 2019

RIGHT ASCENSION AND DECLINATION FOR 0^h TERRESTRIAL TIME

Date		Apparent Right Ascension			Red. To Astrom. (J 2000.0)	Apparent Declination			Red. To Astrom. (J 2000.0)	True Distance from the Earth	Hor. Parallax	Ephemeris Transit	
		h	m	s	s	°	'	"	"		"	h	m
Aug.	19	19	31	32.58	+70.31	-22	15	04.2	-154.00	33.024 476	0.27	21	40
	24	19	31	09.59	70.27	22	16	20.1	153.28	33.079 531	0.27	21	20
	29	19	30	48.75	70.28	22	17	31.0	152.56	33.140 255	0.27	21	00
Sept.	3	19	30	30.16	70.22	22	18	36.4	151.70	33.206 241	0.26	20	40
	8	19	30	14.12	70.18	22	19	35.7	151.22	33.276 992	0.26	20	20
	13	19	30	00.74	70.13	22	20	29.2	150.52	33.351 985	0.26	20	00
	18	19	29	50.11	+70.03	-22	21	16.2	-149.95	33.430 710	0.26	19	40
	23	19	29	42.45	69.97	22	21	56.4	149.68	33.512 647	0.26	19	20
	28	19	29	37.81	69.90	22	22	30.1	149.17	33.597 249	0.26	19	01
Oct.	3	19	29	36.26	69.80	22	22	56.8	149.02	33.683 901	0.26	18	41
	8	19	29	37.92	69.73	22	23	16.5	148.91	33.771 944	0.26	18	21
	13	19	29	42.72	69.62	22	23	29.5	148.69	33.860 752	0.26	18	02
	18	19	29	50.70	+69.52	-22	23	35.2	-148.87	33.949 720	0.26	17	42
	23	19	30	01.88	69.46	22	23	34.2	149.02	34.038 253	0.26	17	23
	28	19	30	16.14	69.35	22	23	26.5	149.13	34.125 729	0.26	17	03
Nov.	2	19	30	33.53	69.28	22	23	11.8	149.67	34.211 485	0.26	16	44
	7	19	30	53.87	69.21	22	22	50.9	149.97	34.294 883	0.26	16	25
	12	19	31	17.03	69.10	22	22	23.7	150.47	34.375 345	0.26	16	05
	17	19	31	42.96	+69.05	-22	21	50.2	-151.24	34.452 336	0.26	15	46
	22	19	32	11.46	68.99	22	21	11.3	151.75	34.525 335	0.25	15	27
	27	19	32	42.38	68.93	22	20	26.6	152.63	34.593 803	0.25	15	08
Dec.	2	19	33	15.59	68.91	22	19	37.0	153.50	34.657 216	0.25	14	49
	7	19	33	50.79	68.85	22	18	42.8	154.24	34.715 123	0.25	14	30
	12	19	34	27.82	68.82	22	17	44.1	155.33	34.767 150	0.25	14	11
	17	19	35	06.49	+68.83	-22	16	41.8	-156.31	34.812 970	0.25	13	52
	22	19	35	46.49	68.79	22	15	36.2	157.25	34.852 273	0.25	13	33
	27	19	36	27.69	68.82	22	14	27.6	158.50	34.884 753	0.25	13	14
	32	19	37	09.77	68.83	22	13	16.9	159.47	34.910 171	0.25	12	55
	37	19	37	52.45	+68.82	-22	12	04.5	-160.58	34.928 382	0.25	12	36

N.B: Pluto is now classified as a dwarf planet as per resolution of I A U

MAJOR PLANETS, 2019

HELIOCENTRIC OSCULATING ORBITAL ELEMENT
REFERRED TO THE MEAN ECLIPTIC AND EQUINOX OF J 2000.0

Date	Julian Date 245	Inclina- tion i	Longitude Asc. Node Ω	Longitude Perihelion ϖ	Mean Distance a	Daily Motion n	Eccentricity e	Mean Longitude L
MERCURY								
		°	°	°		°		°
Dec' 18 28	8480.5	7.0039	48.308	77.486	0.387 097	4.092 36	0.205 651	194.6656
Feb' 19 6	8520.5	7.0039	48.308	77.487	0.387 098	4.092 36	0.205 650	358.3596
Mar 18	8560.5	7.0039	48.308	77.486	0.387 098	4.092 36	0.205 650	162.0537
Apr 27	8600.5	7.0039	48.307	77.487	0.387 099	4.092 34	0.205 646	357.7475
Jun 6	8640.5	7.0039	48.307	77.486	0.387 098	4.092 35	0.205 643	129.4408
Jul 16	8680.5	7.0038	48.307	77.488	0.387 100	4.092 33	0.205 640	293.1339
Aug 25	8720.5	7.0038	48.307	77.489	0.387 099	4.092 34	0.205 640	96.8272
Oct 4	8760.5	7.0038	48.307	77.489	0.387 098	4.092 35	0.205 647	260.5200
Nov 13	8800.5	7.0038	48.307	77.489	0.387 098	4.092 36	0.205 651	64.2144
Dec' 19 23	8840.5	7.0038	48.307	77.489	0.387 098	4.092 36	0.205 651	227.9086
Feb' 20 1	8880.5	7.0038	48.306	77.490	0.387 097	4.092 37	0.205 651	31.6028
Mar' 20 12	8920.5	7.0038	48.306	77.489	0.387 097	4.092 37	0.205 652	195.2971
VENUS								
Dec' 18 28	8480.5	3.3946	76.625	131.47	0.723 327	1.602 15	0.006 735	133.5529
Feb' 19 6	8520.5	3.3946	76.625	131.49	0.723 325	1.602 16	0.006 730	197.6395
Mar 18	8560.5	3.3946	76.625	131.56	0.723 329	1.602 14	0.006 734	261.7249
Apr 27	8600.5	3.3946	76.625	131.55	0.723 325	1.602 15	0.006 740	325.8106
Jun 6	8640.5	3.3946	76.625	131.51	0.723 328	1.602 15	0.006 739	29.8969
Jul 16	8680.5	3.3946	76.625	131.45	0.723 331	1.602 13	0.006 736	93.9818
Aug 25	8720.5	3.3946	76.625	131.43	0.723 328	1.602 14	0.006 730	158.0670
Oct 4	8760.5	3.3946	76.625	131.46	0.723 329	1.602 14	0.006 729	222.1530
Nov 13	8800.5	3.3946	76.625	131.51	0.723 331	1.602 14	0.006 733	286.2376
Dec' 19 23	8840.5	3.3946	76.625	131.53	0.723 324	1.602 16	0.006 744	350.3230
Feb' 20 1	8880.5	3.3946	76.625	131.50	0.723 326	1.602 15	0.006 746	54.4099
Mar' 20 12	8920.5	3.3946	76.625	131.46	0.732 233	1.602 15	0.006 746	118.4955
EARTH*								
Dec' 18 28	8480.5	0.0026	176.2	102.990	1.000 010	0.985 60	0.016 738	96.1582
Feb' 19 6	8520.5	0.0026	176.2	102.981	0.999 999	0.985 61	0.016 727	135.5824
Mar 18	8560.5	0.0026	176.3	102.971	0.999 992	0.985 62	0.016 719	175.0075
Apr 27	8600.5	0.0026	176.4	102.993	0.999 998	0.985 61	0.016 717	214.4324
Jun 6	8640.5	0.0026	176.7	103.042	1.000 006	0.985 60	0.016 720	253.8553
Jul 16	8680.5	0.0026	176.9	103.087	0.999 996	0.985 62	0.016 734	293.2779
Aug 25	8720.5	0.0026	176.9	103.129	0.999 979	0.985 64	0.016 746	332.7025
Oct 4	8760.5	0.0026	176.9	103.125	0.999 981	0.985 64	0.016 747	12.1281
Nov 13	8800.5	0.0026	176.8	103.073	0.999 996	0.985 62	0.016 749	51.5530
Dec' 19 23	8840.5	0.0026	176.8	103.029	1.000 007	0.985 60	0.016 754	90.9764
Feb' 20 1	8880.5	0.0026	176.6	103.001	1.000 008	0.985 60	0.016 755	130.3994
Mar' 20 12	8920.5	0.0026	176.6	102.981	1.000 002	0.985 61	0.016 750	169.8236

* Values labelled for the Earth are actually for the Earth/ Moon barycenter

FORMULAS

Mean anomaly, $M = L - \varpi$

Argument of perihelion, measured from node, $\omega = \varpi - \Omega$

True anomaly, $\nu = M + (2e - e^3/4)\sin M + (5e^2/4)\sin 2M + (13e^3/12)\sin 3M + \ldots$ in radians

True distance, $r = a(1 - e^2)/(1 + e\cos\nu)$

Heliocentric rectangular co- ordinates, referred to the ecliptic of date, may be computed from:

$x = r\{\cos(\nu + \omega)\cos\Omega - \sin(\nu + \omega)\cos i \sin\Omega\}$

$y = r\{\cos(\nu + \omega)\sin\Omega + \sin(\nu + \omega)\cos i \cos\Omega\}$

$z = r\sin(\nu + \omega)\sin i$

MAJOR PLANETS, 2019
HELIOCENTRIC OSCULATING ORBITAL ELEMENT
REFERRED TO THE MEAN ECLIPTIC AND EQUINOX OF J 2000.0

Date		Julian Date 245	Inclina- tion i	Longitude Asc. Node Ω	Longitude Perihelion ϖ	Mean Distance a	Daily Motion n	Eccentricity e	Mean Longitude L
					MARS				
			°	°	°		°		°
Dec' 18	28	8480.5	1.8481	49.504	336.204	1.523 73	0.524 017	0.093 373	29.8803
Feb' 19	6	8520.5	1.8481	49.504	336.203	1.523 73	0.524 015	0.093 384	50.8396
Mar	18	8560.5	1.8481	49.504	336.199	1.523 72	0.524 018	0.093 400	71.7986
Apr	27	8600.5	1.8481	49.504	336.198	1.523 71	0.524 025	0.093 419	92.7574
Jun	6	8640.5	1.8481	49.503	336.197	1.523 70	0.524 032	0.093 436	113.7171
Jul	16	8680.5	1.8481	49.503	336.195	1.523 67	0.524 045	0.093 454	134.6780
Aug	25	8720.5	1.8481	49.502	336.192	1.523 64	0.524 059	0.093 472	155.6402
Oct	4	8760.5	1.8481	49.501	336.189	1.523 62	0.524 072	0.093 492	176.6037
Nov	13	8800.5	1.8481	49.501	336.189	1.523 60	0.524 080	0.093 505	197.5675
Dec' 19	23	8840.5	1.8481	49.501	336.184	1.523 61	0.524 075	0.093 505	218.5313
Feb' 20	1	8880.5	1.8480	49.501	336.169	1.523 65	0.524 055	0.093 495	239.4939
Mar' 20	12	8920.5	1.8480	49.501	336.142	1.523 72	0.524 020	0.093 482	260.4543
					JUPITER				
Dec' 18	28	8480.5	1.3037	100.515	14.170	5.202 65	0.083 095	0.048 814	250.6732
Feb' 19	6	8520.5	1.3037	100.515	14.140	5.202 82	0.083 091	0.048 792	253.9965
Mar	18	8560.5	1.3037	100.515	14.108	5.202 97	0.083 087	0.048 778	257.3203
Apr	27	8600.5	1.3037	100.516	14.089	5.203 05	0.083 086	0.048 776	260.6444
Jun	6	8640.5	1.3037	100.516	14.085	5.203 07	0.083 085	0.048 772	263.9676
Jul	16	8680.5	1.3036	100.516	14.075	5.203 13	0.083 084	0.048 762	267.2903
Aug	25	8720.5	1.3037	100.516	14.060	5.203 22	0.083 082	0.048 748	270.6126
Oct	4	8760.5	1.3037	100.516	14.034	5.203 34	0.083 079	0.048 738	273.9353
Nov	13	8800.5	1.3037	100.516	14.024	5.203 39	0.083 078	0.0487328	277.2587
Dec' 19	23	8840.5	1.3036	100.516	14.020	5.203 41	0.083 077	0.0487233	280.5801
Feb' 20	1	8880.5	1.3036	100.516	14.019	5.203 41	0.083 077	0.048 708	283.9014
Mar' 20	12	8920.5	1.3036	100.516	13.999	5.203 50	0.083 075	0.048 686	287.2220
					SATURN				
Dec' 18	28	8480.5	2.4864	113.594	92.940	9.570 4	0.033 310	0.051 781	281.9768
Feb' 19	6	8520.5	2.4864	113.594	92.850	9.570 9	0.033 308	0.051 741	283.3179
Mar	18	8560.5	2.4863	113.595	92.744	9.571 4	0.033 305	0.051 705	284.6606
Apr	27	8600.5	2.4863	113.595	92.626	9.571 7	0.033 303	0.051 692	286.0049
Jun	6	8640.5	2.4862	113.595	92.514	9.571 8	0.033 303	0.051 707	287.3491
Jul	16	8680.5	2.4862	113.595	92.404	9.571 9	0.033 302	0.051 724	288.6931
Aug	25	8720.5	2.4862	113.595	92.293	9.572 0	0.033 302	0.051 743	290.0373
Oct	4	8760.5	2.4863	113.595	92.170	9.572 2	0.033 301	0.051 757	291.3825
Nov	13	8800.5	2.4862	113.595	92.041	9.572 3	0.033 301	0.051 794	292.7290
Dec' 19	23	8840.5	2.4862	113.595	91.920	9.572 2	0.033 301	0.051 846	294.0755
Feb' 20	1	8880.5	2.4862	113.595	91.806	9.572 0	0.033 302	0.051 906	295.4216
Mar' 20	12	8920.5	2.4863	113.595	91.692	9.572 1	0.033 302	0.051 951	296.7670
					URANUS				
Dec' 18	28	8480.5	0.7710	74.057	174.50	19.124 2	0.011 793	0.049 129	34.4504
Mar' 19	18	8560.5	0.7708	74.066	174.52	19.128 2	0.011 789	0.048 830	35.3703
Jun	6	8640.5	0.7708	74.069	174.42	19.134 5	0.011 783	0.048 457	36.2933
Aug	25	8720.5	0.7707	74.076	174.30	19.140 4	0.011 778	0.048 118	37.2192
Nov' 19	13	8800.5	0.7706	74.083	174.12	19.147 3	0.011 771	0.047 739	38.1445
Feb' 20	1	8880.5	0.7705	74.085	173.89	19.154 5	0.011 765	0.047 388	39.0751
Apr' 20	21	8960.5	0.7704	74.090	173.70	19.160 7	0.011 759	0.047 066	40.0033
					NEPTUNE				
Dec' 18	28	8480.5	1.7712	131.798	34.37	30.074 4	0.005 980	0.006 820	346.0876
Mar' 19	18	8560.5	1.7711	131.795	30.80	30.090 8	0.005 975	0.007 148	346.5588
Jun	6	8640.5	1.7708	131.788	27.78	30.108 7	0.005 970	0.007 596	347.0390
Aug	25	8720.5	1.7706	131.784	25.55	30.124 6	0.005 965	0.008 024	347.5209
Nov' 19	13	8800.5	1.7704	131.780	23.51	30.142 0	0.005 960	0.008 522	348.0054
Feb' 20	1	8880.5	1.7702	131.775	22.28	30.157 0	0.005 955	0.008 990	348.4950
Apr' 20	21	8960.5	1.7700	131.771	21.06	30.171 5	0.005 951	0.009 434	348.9810

Distances are in astronomical units.

CENTRE OF MASS OF THE SOLAR SYSTEM, 2019

HELIOCENTRIC RECTANGULAR CO-ORDINATES
EQUATORIAL RECTANGULAR CO-ORDINATES OF THE BARYCENTRES S_4 (SUN TO MARS) AND S_9 (SUN TO PLUTO) REFERRED TO THE MEAN EQUINOX AND EQUATOR OF J 2000.0

Date		Barycentre S_4 (In units of 10^{-10} a.u)			Centre of Mass of the Solar System Barycentre S_9 (In units of 10^{-9} a.u)		
		x	y	z	X	Y	Z
Jan.	0	+07465362	-68329087	-28995804	+0748021	-6836928	-2901421
	10	08245471	68504544	29093775	0826822	6853985	2911014
	20	09032407	68673180	29189086	0906145	6870244	2920283
	30	09826352	68834086	29281323	0985993	6885656	2929206
Feb.	9	10627189	68986404	29370062	1066354	6900176	2937760
	19	11434504	69129452	29454984	1147201	6913767	2945928
Mar.	1	+12247964	-69262944	-29535991	+1228511	-6926412	-2953704
	11	13067777	69386378	29612915	1310287	6938084	2961078
	21	13893765	69498613	29685229	1392515	6948723	2968023
	31	14724945	69598791	29752445	1475138	6958284	2974513
Apr.	10	15560210	69686495	29814298	1558095	6966744	2980534
	20	16398412	69761591	29870657	1641321	6974094	2986078
	30	+17238470	-69824205	-29921519	+1724756	-6980338	-2991144
May	10	18079320	69874709	29967002	1808339	6985493	2995737
	20	18920050	69913844	30007402	1892019	6989594	2999870
	30	19760359	69942716	30043304	1975773	6992694	3003572
June	9	20600835	69961916	30075068	2059624	6994821	3006860
	19	21441724	69971411	30102690	2143577	6995972	3009733
	29	+22282974	-69971273	-30126180	+2227623	-6996148	-3012190
July	9	23124564	69961710	30145640	2311753	6995359	3014236
	19	23966605	69942876	30161151	2395966	6993611	3015874
	29	24809238	69914801	30172744	2480262	6990903	3017104
Aug.	8	25652503	69877517	30180466	2564635	6987237	3017929
	18	26496452	69831156	30184410	2649082	6982617	3018352
	28	+27341600	-69775937	-30184790	+2733620	-6977053	-3018383
Sept.	7	28188816	69711300	30181445	2818286	6970517	3018014
	17	29038154	69636194	30173879	2903075	6962954	3017219
	27	29889105	69549873	30161686	2987954	6954327	3015977
Oct.	7	30740973	69451839	30144597	3072882	6944610	3014275
	17	31592904	69341791	30122400	3157807	6933787	3012101
	27	+32443990	-69219633	-30094978	+3242678	-6921853	-3009449
Nov.	6	33293147	69085569	30062359	3327432	6908817	3006320
	16	34139480	68940317	30024819	3412017	6894715	3002727
	26	34982882	68784761	29982822	3496421	6879591	2998694
Dec.	6	35823564	68619128	29936455	3580646	6863456	2994224
	16	36661238	68443485	29885680	3664670	6846313	2989315
	26	+37495497	-68258243	-29830615	+3748466	-6828183	-2983973
	36	+38326097	-68063976	-29771478	+3832013	-6809094	-2978209

The heliocentric equatorial rectangular co-ordinates of the barycentre of the solar system referred to the mean equator and equinox of J 2019.5 are given by $\mathbf{r} = P\mathbf{r_0}$, where $\mathbf{r}$ and $\mathbf{r_0}$ are the column vectors of the co-ordinates X,Y, Z and X_0,Y_0, Z_0 referred to J 2019.5 and J 2000.0 respectively.

PART - II

STARS

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY 2^d.875 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
35	280	α Sculptoris	4.31	0	46	00.85	50.620	+0.025	-32	30	46.87	+0.040	-0.007
9	74	ι Ceti	3.56	1	11	19.73	50.350	-0.028	-10	01	17.67	+0.020	-0.028
82	674	φ Eridani	3.56	1	16	37.63	51.180	+0.110	-58	59	09.09	-0.030	-0.082
902	9072	ω Piscium	4.01	2	51	22.41	50.330	+0.095	+6	21	44.50	-0.100	-0.167
22	188	β Ceti	2.04	2	51	29.51	50.710	+0.242	-20	47	00.88	0.000	-0.068
783	7957	η Cephei	3.43	4	57	17.74	51.240	+2.354	+71	46	55.96	+0.450	+0.369
156	1336	α Reticuli	3.35	7	47	30.41	52.760	+0.298	-78	02	24.01	+0.090	-0.015
869	8762	ο Andromedae	3.62	8	02	58.57	49.880	+0.022	+43	45	02.55	+0.090	-0.017
848	8585	α Lacertae	3.77	8	24	48.16	49.890	+0.200	+53	17	26.75	+0.040	-0.070
7	39	γ Pegasi	2.83	9	25	40.45	50.200	+0.001	+12	36	01.67	+0.100	-0.011
40	334	η Ceti	3.45	12	02	29.22	50.580	+0.151	-16	07	07.70	-0.070	-0.213
803	8162	α Cephei	2.44	13	02	45.84	49.480	+0.340	+68	54	50.20	+0.040	-0.100
836	8465	ζ Cephei	3.35	14	13	51.64	49.520	+0.028	+61	08	52.60	+0.150	-0.008
1	15	α Andromedae*	2.06	14	34	48.21	50.140	+0.056	+25	40	48.63	-0.050	-0.207
47	402	θ Ceti	3.6	16	29	53.90	50.250	-0.163	-15	46	02.73	0.000	-0.171
723	7310	δ Draconis	3.07	17	25	09.25	47.560	+0.757	+82	53	12.33	+0.080	-0.093
59	509	τ Ceti	3.5	18	05	05.07	49.130	-1.370	-24	48	24.96	+1.650	+1.463
890	8961	λ Andromedae	3.82v	18	33	23.20	49.750	-0.133	+43	46	28.22	-0.250	-0.441
1075	794	ι Eridani	4.11	19	02	52.47	51.010	+0.169	-51	42	49.97	+0.100	-0.095
71	585	ν Ceti	4	19	42	08.87	50.690	+0.134	-31	02	00.42	+0.120	-0.076
1033	361	ζ Piscium*	5.24	20	09	02.06	50.410	+0.112	+0	12	46.62	+0.090	-0.106
20	165	δ Andromedae	3.27	22	05	07.52	50.200	+0.092	+24	21	03.92	+0.080	-0.141
62	539	ζ Ceti	3.73	22	13	24.66	50.480	+0.025	-20	20	01.31	+0.160	-0.051
106	897	θ Eridani p	3.25	23	32	51.34	50.800	-0.051	-53	44	19.73	+0.260	+0.038
101	841	β Fornacis	4.46	26	30	37.64	50.920	+0.212	-45	51	15.03	+0.350	+0.103
1154	2015	δ Doradus	4.35	26	47	08.23	63.100	-0.278	-88	15	08.32	+0.280	+0.030
50	437	η Piscium	3.62	27	05	17.86	50.280	+0.024	+5	22	44.00	+0.230	-0.015
33	269	μ Andromedae	3.87	29	26	50.78	50.250	+0.174	+29	39	35.90	+0.220	-0.038
42	337	β Andromedae	2.06	30	40	38.42	50.230	+0.126	+25	56	37.90	+0.100	-0.178
863	8694	ι Cephei	3.52	33	30	27.32	49.290	-0.304	+62	37	03.09	+0.280	-0.017
66	553	β Arietis*	2.64	34	14	32.52	50.290	+0.051	+8	29	17.17	+0.150	-0.138
1085	919	τ^3 Eridani	4.09	34	48	27.31	50.390	-0.198	-38	54	15.83	+0.300	+0.001
17	153	ζ Cassiopeiae	3.66	35	20	08.98	49.950	+0.016	+44	43	16.82	+0.290	-0.018
2	21	β Cassiopeiae	2.27	35	23	21.03	50.310	+0.463	+51	12	50.56	-0.170	-0.472
809	8238	β Cephei	3.23	35	48	47.58	49.280	+0.028	+71	09	15.81	+0.300	-0.008
64	544	α Trianguli	3.41	37	07	56.33	50.110	-0.079	+16	48	03.65	+0.090	-0.223
91	779	δ Ceti	4.07	37	50	39.52	50.400	+0.013	-14	27	36.13	+0.310	-0.008
74	617	α Arietis	2	37	56	06.94	50.360	+0.130	+9	57	56.64	+0.120	-0.204
21	168	α Cassiopeiae	2.23	38	03	15.70	49.970	+0.036	+46	37	24.99	+0.270	-0.056
171	1465	α Doradus	3.27	38	06	33.71	51.690	+0.155	-74	34	48.88	+0.290	-0.031
104	874	η Eridani	3.89	39	01	23.74	50.450	+0.008	-24	32	46.46	+0.090	-0.233

* **No. 1 : *Alpheratz*, Uttara Bhadrapada - 2** **No. 66 : *Sheratan*, Asvini**
No. 1033 : Revati

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY 2^d.875 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
75	622	β Trianguli	3	42	37	30.23	50.310	+0.134	+20	34	55.45	+0.250	-0.091
79	664	γ Trianguli	4.01	43	47	24.40	50.220	+0.028	+18	56	59.43	+0.290	-0.064
32	264	γ Cassiopeiae	var.	44	12	06.34	49.970	+0.027	+48	49	00.17	+0.330	-0.019
73	603	γ Andromed. p	2.26	44	29	49.61	50.160	+0.024	+27	48	28.08	+0.290	-0.065
107	911	α Ceti	2.53	44	35	33.90	50.330	-0.032	-12	35	02.60	+0.290	-0.072
155	1326	α Horologii	3.86	46	05	56.36	50.770	-0.073	-61	43	48.11	+0.150	-0.211
48	403	δ Cassiopeiae	2.68	48	12	09.18	50.330	+0.323	+46	24	15.84	+0.170	-0.202
127	1084	ε Eridani	3.73	48	26	07.05	49.390	-1.054	-27	42	43.86	+0.660	+0.281
100	838	41 Arietis*	3.63	48	28	32.93	50.270	+0.029	+10	27	03.71	+0.250	-0.132
135	1136	δ Eridani	3.54	51	08	09.21	50.550	+0.114	-28	40	12.84	+1.140	+0.744
121	1030	ο Tauri	3.6	51	26	08.94	50.260	-0.085	-9	19	56.83	+0.330	-0.059
123	1038	ξ Tauri	3.74	52	11	05.71	50.380	+0.049	-8	47	48.35	+0.340	-0.053
212	1922	β Doradus	3.48v	52	24	39.41	53.280	+0.072	-85	02	31.37	+0.400	+0.007
149	1231	γ Eridani	2.95	54	08	27.53	50.490	+0.039	-33	12	02.23	+0.280	-0.123
63	542	ε Cassiopeiae	3.38	55	02	05.17	50.070	+0.024	+47	33	00.86	+0.370	-0.034
109	921	ρ Persei	var.	55	10	59.88	50.310	+0.099	+20	34	33.92	+0.260	-0.139
1129	1502	α Caeli	4.45	56	25	15.39	50.390	-0.346	-62	59	10.07	+0.380	-0.032
111	936	β Persei	var.	56	26	22.28	50.210	+0.003	+22	25	50.85	+0.410	-0.002
103	854	τ Persei	3.95	58	11	00.34	50.150	-0.003	+34	22	24.72	+0.420	-0.005
99	834	η Persei	3.76	58	58	24.43	50.150	+0.013	+37	29	02.62	+0.400	-0.019
136	1142	17 Tauri	3.7	59	41	03.41	50.280	+0.009	+4	11	30.79	+0.370	-0.049
170	1464	υ^2 Eridani	3.82	60	09	31.16	50.470	-0.076	-51	48	53.66	+0.420	-0.002
151	1251	ν Tauri	3.91	60	11	30.72	50.360	+0.005	-14	26	57.83	+0.420	-0.004
139	1165	η Tauri*	2.87	60	15	53.15	50.290	+0.008	+4	03	10.72	+0.370	-0.049
108	915	γ Persei	2.93	60	17	35.31	50.160	-0.002	+34	31	57.09	+0.420	-0.004
893	8974	γ Cephei	3.21	60	21	53.45	50.150	+0.268	+64	40	22.31	+0.540	+0.119
150	1239	λ Tauri	3.47v	60	54	25.35	50.320	-0.009	-7	57	27.13	+0.410	-0.011
120	1017	α Persei	1.79	62	21	10.35	50.210	+0.018	+30	07	39.70	+0.410	-0.030
144	1203	ζ Persei	2.85	63	23	45.95	50.270	+0.004	+11	20	08.87	+0.430	-0.011
134	1135	ν Persei	3.77	64	05	42.43	50.210	-0.015	+22	09	21.51	+0.440	+0.002
131	1122	δ Persei	3.01	65	04	26.91	50.230	+0.021	+27	18	14.26	+0.400	-0.040
148	1228	ξ Persei	4.04	65	14	40.70	50.250	+0.002	+14	56	46.36	+0.440	0.000
147	1220	ε Persei	2.89	65	56	59.91	50.250	+0.013	+19	07	00.51	+0.420	-0.029
159	1346	γ Tauri	3.65	66	04	43.90	50.420	+0.110	-5	43	48.40	+0.390	-0.044
162	1373	δ Tauri	3.76	67	08	37.42	50.410	+0.101	-3	58	02.45	+0.400	-0.047
164	1409	ε Tauri	3.54	68	44	16.88	50.400	+0.100	-2	33	54.08	+0.400	-0.054
168	1457	α Tauri*	0.85	70	03	42.67	50.340	+0.036	-5	27	57.42	+0.250	-0.197
1134	1543	π^3 Orionis	3.19	72	11	59.67	50.800	+0.481	-15	22	55.04	+0.410	-0.046
186	1654	ε Leporis	3.19	72	19	43.28	50.420	+0.021	-44	57	45.17	+0.390	-0.076
179	1552	π^4 Orionis	3.69	72	22	24.21	50.330	-0.001	-16	46	09.91	+0.460	+0.001
180	1567	π^5 Orionis	3.72	72	45	48.18	50.330	0.000	-20	00	09.36	+0.460	0.000

* **No. 100 : Bharani** **No. 168 : *Aldebaran*, Rohini**
No. 139 : *Alcyone* , Krittika.

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY $2^{d}.875$ TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
188	1666	β Eridani	2.79	75	32	52.28	50.220	-0.116	-27	51	34.69	+0.400	-0.071
1144	1702	μ Leporis	3.31v	75	40	02.16	50.400	+0.051	-39	02	51.80	+0.430	-0.030
695	6927	χ Draconis	3.57	76	10	11.20	44.140	+3.496	+83	34	16.66	+0.620	-0.501
181	1577	ι Aurigae	2.69	76	54	42.52	50.290	+0.001	+10	27	24.91	+0.450	-0.018
194	1713	β Orionis	0.12	77	06	07.94	50.340	0.000	-31	07	12.95	+0.460	-0.001
195	1735	τ Orionis	3.6	78	07	10.90	50.310	-0.018	-29	50	06.62	+0.460	-0.007
1137	1612	ζ Aurigae	3.75	78	54	20.72	50.290	+0.007	+18	12	16.95	+0.450	-0.023
183	1605	ε Aurigae	var.	79	06	49.40	50.270	-0.001	+20	56	48.79	+0.460	-0.004
185	1641	η Aurigae	3.17	79	43	07.09	50.300	+0.024	+18	17	09.58	+0.390	-0.070
204	1829	β Leporis	2.84	79	56	41.80	50.320	-0.015	-43	54	44.98	+0.380	-0.088
201	1790	γ Orionis	1.64	81	13	07.87	50.290	-0.010	-16	48	49.01	+0.450	-0.013
178	1542	α Camelopardi	4.29	81	15	06.72	50.270	+0.001	+43	25	17.35	+0.480	+0.006
182	1603	β Camelopardi	4.03	81	32	24.18	50.270	-0.010	+37	26	00.57	+0.450	-0.015
207	1865	α Leporis	2.58	81	39	11.05	50.330	+0.001	-41	03	18.91	+0.470	+0.002
193	1708	α Aurigae	0.08	82	07	49.84	50.330	+0.046	+22	51	52.31	+0.030	-0.429
215	1956	α Columbae	2.64	82	26	30.93	50.340	+0.009	-57	22	22.19	+0.440	-0.027
206	1852	δ Orionis	2.23	82	40	08.18	50.300	+0.002	-22	57	11.11	+0.470	-0.002
202	1791	β Tauri	1.65	82	50	50.65	50.300	+0.012	+5	23	12.00	+0.290	-0.176
209	1899	ι Orionis	2.77	83	16	11.85	50.310	0.000	-29	11	50.81	+0.470	+0.001
210	1903	ε Orionis	1.7	83	44	09.88	50.300	+0.001	-24	30	13.93	+0.470	-0.002
(GC)	1879	λ Orionis*	3.56	83	58	45.32	50.300	-0.001	-13	22	00.87	+0.460	-0.002
211	1910	ζ Tauri	3	85	03	25.32	50.290	0.000	-2	11	35.54	+0.450	-0.021
217	1983	γ Leporis	3.6	85	06	57.82	49.850	-0.440	-45	49	03.45	+0.110	-0.359
219	1998	ζ Leporis	3.55	86	15	30.98	50.270	-0.020	-38	12	47.83	+0.470	0.000
220	2004	κ Orionis	2.06	86	40	15.62	50.290	+0.002	-33	04	05.31	+0.470	-0.002
223	2040	β Columbae	3.12	86	41	33.14	50.410	+0.136	-59	10	29.53	+0.870	+0.399
222	2035	δ Leporis	3.81	87	26	28.11	50.570	+0.301	-44	17	53.08	-0.180	-0.653
907	424	α Ursae Mins.	2.02	88	50	25.96	50.400	+0.037	+66	06	13.67	+0.420	-0.036
224	2061	α Orionis*	var.	89	01	37.64	50.310	+0.027	-16	01	27.96	+0.480	+0.009
226	2085	η Leporis	3.71	89	10	19.21	50.220	-0.051	-37	36	01.05	+0.610	+0.140
229	2120	η Columbae	3.96	89	53	01.15	50.250	+0.055	-66	15	06.35	+0.450	-0.014
227	2088	β Aurigae	1.9	90	10	57.13	50.250	-0.062	+21	30	38.64	+0.460	0.000
225	2077	δ Aurigae	3.72	90	11	33.72	50.420	+0.095	+30	50	50.35	+0.340	-0.125
1168	2219	κ Aurigae	4.35	93	38	12.33	50.230	-0.066	+6	06	17.07	+0.200	-0.264
241	2286	μ Geminorum	2.88	95	34	28.56	50.350	+0.059	+0	49	05.63	+0.350	-0.109
244	2298	8ε Monocerotis	4.44	96	31	37.33	50.240	-0.019	-18	42	53.86	+0.470	+0.010
1173	2343	ν Geminorum	4.15	97	04	29.20	50.290	-0.007	-3	03	14.22	+0.450	-0.014
243	2294	β Canis Maj.	1.98	97	27	35.13	50.200	-0.008	-41	15	04.45	+0.460	0.000
240	2282	ζ Canis Maj.	3.02	97	38	57.67	50.170	+0.015	-53	22	12.74	+0.460	+0.003
251	2421	γ Geminorum	1.93	99	22	38.17	50.320	+0.045	-6	44	24.91	+0.420	-0.039
254	2473	ε Geminorum	2.98	100	12	40.33	50.300	-0.005	+2	04	20.37	+0.440	-0.014

* **No. GC : *Mrgasiras* .** **No. 224 : *Betelgeuse* , Mag. 0.4 to 1.3 Ardra.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY 2^{d}.875 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
261	2540	θ Geminorum	3.6	101	23	45.52	50.320	+0.002	+11	01	56.41	+0.400	-0.048
256	2484	ξ Geminorum	3.36	101	28	51.38	50.170	-0.101	-10	06	10.35	+0.250	-0.200
257	2491	α Canis Maj cg	-1.46	104	21	00.50	49.610	-0.552	-39	36	34.71	-0.810	-1.256
245	2326	α Carinae	-0.72	105	13	47.98	49.730	+0.075	-75	49	16.96	+0.470	+0.024
269	2650	ζ Geminorum	3.79v	105	15	45.15	50.280	-0.009	-2	02	11.28	+0.440	-0.002
252	2451	ν Puppis	3.17	107	25	05.63	49.900	+0.008	-66	04	18.80	+0.430	-0.006
279	2777	δ Geminorum	3.53	108	47	29.57	50.270	-0.024	+0	10	34.18	+0.410	-0.016
1180	2538	κ Canis Maj.	3.96	108	50	13.50	50.010	-0.013	-55	08	42.71	+0.440	+0.003
277	2763	λ Geminorum	3.58	109	03	03.25	50.240	-0.042	-5	37	59.25	+0.390	-0.043
282	2821	ι Geminorum	3.79	109	13	45.13	50.210	-0.109	+5	45	36.20	+0.320	-0.103
1187	2714	22 δ Monoceroti	4.15	109	39	59.63	50.220	-0.002	-21	44	33.56	+0.430	+0.005
287	2891	α Gemino. *Cg**	1.95	110	30	44.59	50.180	-0.156	+10	05	51.55	+0.300	-0.126
268	2618	ε Canis Maj.	1.5	111	02	02.13	50.040	+0.006	-51	21	28.41	+0.420	+0.003
270	2653	*o*^{2} Canis Maj.	3.02	111	16	26.24	50.070	-0.007	-46	07	41.13	+0.430	+0.002
1183	2646	σ Canis Maj.	3.47	111	49	37.49	50.030	-0.009	-50	13	24.79	+0.420	+0.004
285	2845	β Canis Min.	2.9	112	27	48.90	50.200	-0.047	-13	29	06.74	+0.370	-0.046
317	3323	*o* Ursae Maj.	3.36	113	16	06.95	50.360	-0.121	+40	14	41.58	+0.270	-0.144
295	2990	β Geminorum	1.14	113	29	05.53	49.710	-0.614	+6	41	08.06	+0.250	-0.158
273	2693	δ Canis Maj.	1.86	113	40	01.25	50.040	-0.006	-48	27	03.41	+0.410	+0.004
294	2985	κ Geminorum	3.57	113	56	17.17	50.290	-0.024	+3	04	49.62	+0.350	-0.057
291	2943	α C. Min. *cg*	0.38	116	03	16.59	49.690	-0.541	-16	01	24.69	-0.720	-1.132
263	2553	τ Puppis	2.93	117	59	43.95	49.650	+0.187	-72	51	05.21	+0.340	-0.056
293	2970	26 α Monoceroti	3.93	119	33	07.59	50.060	-0.078	-30	27	05.88	+0.350	-0.033
283	2827	η Canis Maj.	2.45	119	48	25.47	49.960	-0.008	-50	36	23.92	+0.390	+0.004
278	2773	π Puppis	2.7	120	34	14.14	49.830	-0.019	-58	31	22.38	+0.380	+0.002
335	3569	ι Ursae Maj.	3.14	123	04	15.52	50.060	-0.399	+29	34	30.78	+0.010	-0.358
341	3594	κ Ursae Maj.	3.6	124	12	35.81	50.450	-0.015	+28	58	52.19	+0.300	-0.062
312	3249	β Cancri	3.52	124	31	45.50	50.210	-0.032	-10	17	09.39	+0.300	-0.058
321	3366	η Cancri	5.33	125	40	47.93	50.260	-0.035	+1	34	22.78	+0.310	-0.054
1204	3045	ξ Puppis	3.34	126	18	44.66	49.980	-0.003	-44	56	15.25	+0.350	-0.003
368	3888	*ν* Ursae Maj.	3.8	126	32	25.14	50.320	-0.261	+42	39	10.11	+0.090	-0.269
328	3475	ι Cancri	4.02	126	37	07.55	50.340	-0.013	+10	25	41.38	+0.300	-0.047
358	3775	θ Ursae Maj.	3.17	127	31	59.64	49.690	-0.820	+34	53	35.61	-0.520	-0.862
1228	3449	γ Cancri	4.66	127	48	37.63	50.220	-0.092	+3	11	31.18	+0.280	-0.066
1194	2878	ρ Puppis	3.25	128	57	29.29	49.370	-0.262	-63	46	18.68	+0.490	+0.157
326	3461	δ Cancri*	3.94	128	59	40.70	50.340	+0.043	+0	04	39.97	+0.110	-0.225
1223	3410	δ Hydrae	4.16	130	34	33.78	50.160	-0.064	-12	23	27.28	+0.310	-0.024
433	4434	λ Draconis	3.84	130	36	31.95	50.780	-0.026	+57	14	33.98	+0.290	-0.040
1224	3418	σ Hydrae	4.44	131	28	54.04	50.200	-0.013	-14	36	00.82	+0.300	-0.022
308	3185	ρ Puppis	2.81	131	39	31.84	49.850	-0.128	-43	16	05.52	+0.350	+0.023
352	3705	α Lyncis	3.13	132	06	51.42	50.180	-0.227	+17	57	55.67	+0.260	-0.054

* **No. 287 : *Castor*, Punarvasu-2, Mag. 1.95 & 2.95. No. 326 : Pusya.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY 2^d.875 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
1239	3627	ξ Cancri	5.14	133	28	60.00	50.330	0.000	+5	25	32.26	+0.320	+0.005
550	5563	β Ursae Min.	2.08	133	35	52.72	51.410	-0.044	+72	59	20.92	+0.280	-0.031
337	3572	α Cancri	4.25	133	54	50.83	50.310	+0.041	-5	04	43.84	+0.290	-0.020
334	3547	ζ Hydrae	3.11	134	50	49.88	50.130	-0.101	-10	58	04.92	+0.290	-0.014
417	4301	α Ursae Maj.	1.79	135	28	18.39	50.630	-0.087	+49	40	52.11	+0.180	-0.125
(329)	3482	ε Hydrae m*	3.38	136	21	32.03	49.910	-0.228	-23	26	07.67	+0.180	-0.105
472	4787	κ Draconis	3.87v	136	31	55.82	50.890	-0.090	+61	45	48.92	+0.250	-0.042
306	3165	ζ Puppis	2.25	138	49	10.64	49.620	-0.057	-58	20	46.70	+0.270	0.000
416	4295	β Ursae Maj.	2.37	139	42	34.54	50.750	+0.071	+45	08	05.49	+0.350	+0.073
383	4033	λ Ursae Maj.	3.45	139	49	21.46	50.360	-0.155	+29	53	10.49	+0.170	-0.103
347	3665	θ Hydrae	3.88	140	33	41.89	50.430	+0.224	-13	03	07.64	+0.010	-0.255
367	3873	ε Leonis	2.98	140	58	38.76	50.320	-0.040	+9	42	59.93	+0.230	-0.026
386	4069	μ Ursae Maj.	3.05	141	30	28.73	50.410	-0.101	+28	59	58.13	+0.260	-0.003
371	3905	μ Leonis	3.88	141	42	06.88	50.190	-0.188	+12	20	58.40	+0.130	-0.127
569	5735	γ Ursae Min.	3.05	141	52	41.67	51.710	-0.080	+75	14	32.71	+0.230	-0.019
262	2550	α Pictoris	3.27	144	21	33.23	45.060	-1.937	-83	02	15.84	+0.380	+0.148
365	3852	ο Leonis	3.52	144	31	07.29	50.150	-0.122	-3	45	22.84	+0.150	-0.081
327	3468	α Pyxidis	3.68	146	46	12.81	49.800	-0.022	-48	55	17.94	+0.230	+0.006
354	3748	α Hydrae	1.98	147	33	02.14	50.100	-0.026	-22	22	51.99	+0.250	+0.026
309	3207	γ^2 Velorum	1.78	147	37	02.38	49.410	-0.015	-64	27	46.79	+0.220	+0.004
384	4031	ζ Leonis	3.44	147	50	18.47	50.400	+0.020	+11	51	58.39	+0.210	0.000
1250	3845	ι Hydrae	3.91	147	54	50.65	50.260	+0.070	-14	16	34.83	+0.170	-0.044
379	3975	η Leonis	3.52	148	10	39.80	50.330	-0.001	+4	52	00.66	+0.210	-0.001
420	4335	ψ Ursae Maj.	3.01	149	05	12.50	50.540	-0.054	+35	32	18.81	+0.150	-0.055
380	3982	α Leonis*	1.35	150	06	01.16	50.060	-0.235	+0	27	55.69	+0.110	-0.082
447	4554	γ Ursae Maj.	2.44	150	45	08.77	50.860	+0.104	+47	08	34.50	+0.250	+0.065
303	3117	χ Carinae	3.47	150	59	39.82	49.000	-0.105	-70	19	32.20	+0.190	+0.001
456	4660	δ Ursae Maj.	3.31	151	20	27.02	50.950	+0.119	+51	39	29.29	+0.260	+0.074
364	3849	κ Hydrae	5.06	152	56	52.63	50.060	-0.020	-26	35	55.35	+0.150	-0.028
1243	3718	θ Pyxidis	4.72	153	19	46.92	49.930	-0.008	-39	02	00.80	+0.160	-0.012
441	4518	χ Ursae Maj.	3.71	153	56	01.29	50.500	-0.177	+41	32	40.44	+0.120	-0.048
396	4133	ρ Leonis	3.85	156	39	40.78	50.290	-0.005	+0	09	01.80	+0.140	-0.005
425	4377	ν Ursae Maj.	3.48	156	55	37.36	50.470	-0.040	+26	09	47.95	+0.160	+0.014
521	5291	α Draconis	3.65	157	44	00.88	51.200	-0.111	+66	21	45.54	+0.110	-0.037
1261	3970	ν^2 Hydrae	4.6	158	35	45.74	50.050	-0.045	-23	10	37.69	+0.140	+0.003
483	4905	ε Ursae Maj.	1.77	159	12	36.34	51.080	+0.150	+54	19	11.61	+0.190	+0.070
381	3994	λ Hydrae	3.61	159	38	15.09	49.950	-0.165	-22	00	50.95	-0.040	-0.159
1270	4116	δ Sextantis	5.21	160	22	42.07	50.160	-0.040	-11	20	42.92	+0.090	-0.031
345	3634	λ Velorum	2.21	161	27	22.58	49.580	-0.040	-55	52	12.75	+0.110	+0.001
422	4357	δ Leonis*	2.56	161	35	26.33	50.600	+0.188	+14	20	01.74	+0.050	-0.062
423	4359	θ Leonis	3.34	163	41	44.63	50.350	-0.025	+9	40	27.35	0.000	-0.096

* **No. 329 : Aslesa.** **No. 422 : *Zosma* , Purva Phalguni-1.**

No. 380 : *Regulus* , Magha.

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY $2^{d}.875$ TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
1227	3447	ο Velorum	3.62	165	00	01.80	49.170	-0.073	-66	16	33.44	+0.090	+0.001
389	4094	μ Hydrae	3.81	165	18	26.14	49.990	-0.093	-24	40	18.28	-0.050	-0.125
497	5054	ζ Ursae Maj. pr	2.27	165	58	38.37	51.180	+0.188	+56	22	46.94	+0.140	+0.067
1304	4527	93 Leonis*	4.53v	169	14	48.34	50.300	-0.140	+17	18	33.28	-0.020	-0.065
410	4232	ν Hydrae	3.11	170	38	14.95	50.110	+0.004	-21	47	48.00	+0.250	+0.221
444	4534	β Leonis	2.14	171	53	17.74	49.980	-0.417	+12	15	55.25	-0.280	-0.306
392	4104	α Antliae	4.25	172	42	38.88	49.840	-0.089	-37	25	39.24	0.000	-0.025
315	3307	ε Carinae	1.86	173	23	35.36	48.700	-0.093	-72	40	47.83	+0.010	-0.011
1283	4287	α Crateris	4.08	173	57	28.94	49.590	-0.512	-22	43	00.08	-0.060	-0.074
485	4915	α CVn sq	2.9	174	50	22.73	50.390	-0.302	+40	07	14.46	-0.070	-0.069
426	4382	δ Crateris	3.56	176	57	26.93	49.940	-0.206	-17	34	18.58	+0.120	+0.139
509	5191	η Ursae Maj.	1.86	177	12	29.71	50.790	-0.155	+54	23	14.91	-0.100	-0.083
445	4540	β Virginis	3.61	177	26	27.28	51.090	+0.789	+0	41	39.75	+0.030	+0.047
353	3734	κ Velorum	2.5	179	09	33.32	49.320	-0.027	-63	43	18.86	-0.040	0.000
531	5404	θ Bootis	4.05	182	53	16.71	51.250	+0.148	+60	06	21.67	-0.520	-0.456
639	6396	ζ Draconis	3.17	183	40	44.04	55.060	-0.288	+84	45	39.92	-0.080	-0.014
361	3803	N Velorum	3.13	184	28	50.40	49.280	-0.056	-64	14	20.37	-0.100	-0.020
492	4983	β Com	4.26	184	37	56.60	49.270	-1.319	+32	30	50.35	+0.350	+0.429
460	4689	η Virginis	3.89	184	34	30.92	50.270	-0.051	+2	35	20.11	-0.120	-0.042
571	5744	ι Draconis	3.29	185	13	44.84	51.590	-0.059	+71	05	35.15	-0.080	+0.004
351	3699	ι Carinae	2.25	185	35	33.38	49.160	-0.048	-67	07	00.87	-0.090	-0.011
1326	4828	ρ Virginis	4.88	185	47	13.08	50.520	+0.116	+13	32	31.98	-0.130	-0.049
375	3940	φVelorum	3.54	186	12	52.76	49.480	-0.019	-59	57	03.63	-0.100	-0.005
434	4450	ξ Hydrae	3.54	188	15	28.63	49.820	-0.193	-31	35	59.43	-0.230	-0.131
488	4932	ε Virginis	2.83	190	12	43.04	50.160	-0.269	+16	12	13.69	-0.210	-0.091
457	4662	γ Corvi	2.59	190	59	47.50	50.020	-0.161	-14	30	06.69	-0.180	-0.045
484	4910	δ Virginis	3.38	191	43	53.27	49.950	-0.415	+8	36	41.10	-0.370	-0.232
453	4630	ε Corvi	3	191	56	11.49	50.060	-0.074	-19	40	27.75	-0.160	-0.018
475	4813	χ Virginis	4.66	192	25	33.82	50.210	-0.060	-3	28	09.13	-0.190	-0.052
465	4757	δ Corvi*	2.95	193	43	22.35	50.060	-0.140	-12	11	53.73	-0.360	-0.211
319	3347	β Volantis	3.77	195	26	17.67	49.130	+0.546	-75	35	11.57	-0.240	-0.082
471	4786	β Corvi	2.65	197	38	23.01	50.170	+0.026	-18	02	45.06	-0.230	-0.048
535	5435	γ Bootis	3.03	197	56	13.78	50.540	-0.268	+49	33	03.66	-0.100	+0.079
513	5235	η Bootis	2.68	199	36	38.75	50.620	+0.095	+28	04	26.82	-0.550	-0.354
281	2803	δ Volantis	3.98	199	40	43.78	47.030	-0.039	-82	28	41.73	-0.200	-0.006
501	5107	ζ Virginis	3.37	201	57	35.64	50.080	-0.284	+9	44	33.68	-0.280	-0.066
534	5429	ρ Bootis	3.58	203	03	33.82	50.480	-0.191	+42	27	03.33	-0.150	+0.066
498	5056	α Virginis*	0.98	204	06	48.87	50.250	-0.028	-2	03	21.35	-0.270	-0.041
526	5340	α Bootis*	-0.04	204	30	21.08	50.260	-0.285	+30	43	21.82	-2.490	-2.265
555	5602	β Bootis	3.5	204	31	33.09	50.820	-0.039	+54	08	58.24	-0.280	-0.044
495	5020	γ Hydrae	3	207	17	26.24	50.280	+0.079	-13	44	38.84	-0.260	-0.016

* **No. 1304 : Uttara Phalguni-2.** **No. 498 : *Spica* , Citra.**
No. 465 : *Algorel* , Hasta. **No. 526 : *Arcturus* , Svati.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY 2^d.875 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
452	4621	δ Centauri	2.6	207	45	09.17	49.870	-0.033	-44	30	40.29	-0.280	-0.026
406	4199	θ Carinae	2.76	209	27	27.13	49.520	-0.046	-62	08	26.11	-0.280	-0.012
348	3685	β Carinae	1.68	212	13	56.56	48.660	-0.463	-72	14	17.86	-0.420	-0.133
496	5028	ι Centauri	2.75	213	23	55.14	49.810	-0.305	-26	01	08.43	-0.510	-0.219
563	5681	δ Bootis	3.47	213	25	59.76	50.900	+0.189	+48	57	48.96	-0.360	-0.068
525	5338	ι Virginis	4.08	214	04	14.91	50.480	+0.140	+7	11	44.59	-0.710	-0.409
523	5315	κ Virginis	4.19	214	45	57.84	50.270	-0.039	+2	54	43.45	-0.160	+0.135
436	4467	λ Centauri	3.13	214	48	47.63	49.700	-0.045	-56	47	27.93	-0.330	-0.033
455	4656	δ Crucis	2.8	215	56	04.37	49.820	-0.042	-50	25	16.96	-0.340	-0.033
468	4763	γ Crucis	1.63v	217	00	40.52	50.170	+0.257	-47	50	02.43	-0.510	-0.199
1371	5359	λ Virginis	4.52	217	13	28.13	50.270	-0.024	+0	29	20.66	-0.290	+0.023
385	4037	ω Carinae	3.32	217	42	26.07	49.420	-0.054	-67	23	03.51	-0.350	-0.033
519	5287	π Hydrae	3.27	218	53	47.07	50.310	+0.092	-13	03	06.95	-0.440	-0.115
572	5747	β Cr. Borealis	3.68	219	23	22.42	50.360	-0.286	+46	03	08.64	-0.310	+0.018
1189	2736	γ^2 Volantis	3.78	220	06	47.69	46.900	-0.682	-82	37	07.71	-0.360	+0.065
545	5487	μ Virginis	3.88	220	24	18.12	50.550	+0.203	+9	40	07.67	-0.600	-0.268
442	4520	λ Muscae	3.64	221	15	37.17	49.580	-0.181	-58	30	32.70	-0.400	-0.054
508	5193	μ Centauri	3.04v	221	48	27.33	50.100	-0.015	-28	58	52.54	-0.370	-0.028
481	4853	β Crucis	1.25	221	54	58.01	49.890	-0.046	-48	38	27.12	-0.380	-0.039
462	4730	α Crucis A	1.33	222	08	23.14	49.840	-0.031	-52	52	51.27	-0.380	-0.032
578	5793	α Cr.Borealis	2.23	222	34	15.67	50.810	+0.201	+44	19	17.17	-0.390	-0.044
520	5288	θ Centauri	2.06	222	34	42.83	49.850	-0.317	-22	05	07.71	-1.020	-0.672
608	6092	τ Herculis	3.89	224	39	36.73	50.910	-0.065	+65	49	41.33	-0.320	+0.032
512	5231	ζ Centauri	2.55	225	13	18.31	50.060	-0.040	-32	56	44.31	-0.420	-0.062
548	5531	α^2 Librae*	2.75	225	21	16.75	50.210	-0.082	+0	19	50.11	-0.460	-0.095
504	5132	ε Centauri	2.3	225	49	32.62	50.030	-0.023	-39	35	17.27	-0.390	-0.028
297	3024	ζ Volantis	3.95	226	01	23.73	48.570	-0.031	-79	23	21.70	-0.340	+0.034
391	4102	I Carinae	4	228	21	11.37	49.660	+0.052	-67	53	06.94	-0.400	-0.027
564	5685	β Librae	2.61	229	38	37.97	50.250	-0.089	+8	29	37.02	-0.420	-0.044
583	5867	β Serpentis	3.67	230	13	20.70	50.570	+0.093	+34	19	27.99	-0.410	-0.026
537	5440	η Centauri	2.31	230	31	13.87	50.150	-0.023	-25	30	55.38	-0.430	-0.044
474	4798	α Muscae	2.69	230	38	38.41	49.850	-0.045	-56	33	33.68	-0.430	-0.043
556	5603	σ Librae	3.29	230	57	33.00	50.200	-0.059	-7	38	48.93	-0.450	-0.062
559	5652	ι Librae	4.54	231	16	37.02	50.260	-0.024	-1	51	06.95	-0.440	-0.047
582	5854	α Serpentis	2.65	232	20	56.44	50.550	+0.134	+25	30	22.73	-0.320	+0.079
591	5933	γ Serpentis	3.85	233	03	31.70	51.230	+0.759	+35	11	14.17	-1.560	-1.164
541	5469	α Lupi	2.3	233	46	31.37	50.140	-0.016	-30	01	41.39	-0.420	-0.024
518	5267	β Centauri	0.61	234	03	47.63	50.040	-0.026	-44	08	23.95	-0.430	-0.032
469	4773	γ Muscae	3.87	234	17	16.97	49.830	-0.069	-58	52	23.08	-0.450	-0.045
588	5892	ε Serpentis	3.71	234	36	16.80	50.520	+0.121	+24	00	18.06	-0.310	+0.091
553	5576	κ Centauri	3.13	235	03	59.57	50.180	-0.011	-24	02	01.71	-0.440	-0.029

* **No. 548 : *Zuben el Genubi*, Visakha.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY 2^{d}.875 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
552	5571	β Lupi	2.68	235	17	50.14	50.160	-0.023	-25	02	55.12	-0.460	-0.048
577	5787	γ Librae	3.91	235	24	39.19	50.380	+0.061	+4	23	01.74	-0.390	+0.024
585	5881	μ Serpentis	3.54	236	12	41.28	50.280	-0.082	+16	14	08.64	-0.450	-0.042
487	4923	δ Muscae	3.62	236	27	44.88	50.320	+0.360	-56	46	36.97	-0.250	+0.163
566	5705	φ' Lupi	3.56	237	45	57.15	50.170	-0.067	-17	10	52.06	-0.520	-0.105
1413	5838	κ Librae	4.74	238	01	46.94	50.280	-0.013	+0	01	19.87	-0.530	-0.109
579	5794	ν Librae	3.58	238	52	53.88	50.250	-0.010	-8	30	35.06	-0.420	0.000
1402	5695	δ Lupi	3.22	238	55	43.74	50.200	-0.008	-21	25	42.26	-0.450	-0.029
626	6220	η Herculis	3.53	239	03	45.84	50.780	+0.116	+60	17	13.87	-0.490	-0.070
609	6095	γ Herculis	3.75	239	29	14.71	50.400	-0.072	+40	00	20.25	-0.390	+0.032
538	5460	α Centauri cg	var.	239	43	24.51	45.210	-4.888	-42	36	11.42	-1.300	-0.862
401	4174	γ Chamaeleontis	4.11	240	41	26.99	49.770	-0.049	-68	05	12.24	-0.470	-0.040
558	5649	ζ Lupi	3.41	241	01	43.77	50.070	-0.099	-32	50	03.95	-0.530	-0.104
618	6148	β Herculis	2.77	241	21	50.32	50.350	-0.126	+42	41	59.51	-0.470	-0.034
613	6117	ω Herculis	4.57	241	50	55.95	50.490	+0.067	+35	09	56.70	-0.480	-0.050
603	6056	δ Ophiuchi	2.74	242	34	29.19	50.340	-0.018	+17	14	16.95	-0.580	-0.149
539	5463	α Circini	3.19	242	38	00.51	50.010	-0.104	-46	12	23.45	-0.720	-0.292
594	5953	δ Scorpii*	2.32	242	50	37.01	50.280	-0.001	-1	59	19.06	-0.480	-0.038
592	5944	π Scorpii	2.89	243	12	43.91	50.270	-0.006	-5	28	40.35	-0.460	-0.027
597	5984	β Scorpii pr	2.62	243	27	44.81	50.290	-0.002	+1	00	19.15	-0.460	-0.020
605	6075	ε Ophiuchi	3.24	243	46	59.45	50.420	+0.079	+16	26	15.42	-0.380	+0.055
459	4674	β Chamaeleontis	4.26	245	42	29.08	49.900	-0.084	-63	35	48.67	-0.480	-0.034
411	4234	δ^2 Chamaeleontis	4.45	245	55	34.82	49.890	-0.030	-67	47	36.11	-0.490	-0.048
607	6084	σ Scorpii	2.89	248	04	18.98	50.280	-0.007	-4	02	23.86	-0.470	-0.022
634	6324	ε Herculis	3.92	248	35	59.88	50.380	-0.085	+53	14	45.62	-0.430	+0.019
622	6175	ζ Ophiuchi	2.56	249	30	06.55	50.330	+0.010	+11	23	20.44	-0.420	+0.028
560	5671	γ Tr. Austrini	2.89	249	39	52.62	50.080	-0.082	-48	06	20.39	-0.510	-0.056
616	6134	α Scorpii cg*	var.	250	02	04.37	50.280	-0.006	-4	34	21.10	-0.480	-0.022
620	6165	τ Scorpii	2.82	251	43	45.36	50.280	-0.005	-6	07	22.91	-0.480	-0.023
633	6299	κ Ophiuchi	3.2	252	05	32.77	50.020	-0.339	+31	50	00.35	-0.500	-0.047
589	5897	β Tr.Australis	2.85	252	06	45.16	50.100	-0.100	-41	57	02.70	-0.890	-0.435
653	6536	β Draconis	2.79	252	14	25.84	50.620	-0.072	+75	16	31.45	-0.450	+0.011
643	6418	π Herculis	3.16	252	20	26.08	50.420	-0.051	+59	32	53.93	-0.450	0.000
542	5470	α Apodis	3.83	254	42	05.21	50.160	-0.002	-58	14	15.07	-0.480	-0.019
641	6410	δ Herculis	3.14	255	02	11.08	50.380	-0.004	+47	40	56.10	-0.620	-0.158
628	6241	ε Scorpii	2.29	255	36	15.51	49.690	-0.588	-11	44	34.21	-0.790	-0.327
1439	6247	μ^1 Scorpii	3.08v	256	25	40.46	50.270	-0.008	-15	25	33.04	-0.490	-0.026
1435	6229	η Arae	3.76	259	10	36.33	50.310	+0.051	-36	16	44.72	-0.490	-0.023
631	6285	ζ Arae	3.13	260	05	45.99	50.250	-0.018	-33	05	39.82	-0.510	-0.038
663	6588	ι Herculis	3.8	260	09	43.71	50.390	-0.015	+69	15	46.85	-0.460	+0.005
638	6380	η Scorpii	3.33	261	00	55.94	50.330	+0.052	-20	11	15.32	-0.750	-0.284

* **No. 594 : *Dschubba*, Anuradha** **No. 616 : *Antares*, Jyestha, Mag. 0.9 to 1.8.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY 2^{d}.875 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
625	6217	α Tr. Austr.	1.92	261	10	05.56	50.290	+0.028	-46	09	14.75	-0.500	-0.031
644	6453	θ Ophiuchi	3.27	261	40	02.20	50.290	-0.002	-1	50	46.12	-0.490	-0.020
656	6556	α Ophiuchi	2.08	262	43	19.32	50.470	+0.163	+35	49	53.29	-0.680	-0.220
611	6102	γ Apodis	3.89	262	58	29.07	50.080	-0.191	-56	00	36.79	-0.580	-0.106
649	6508	ν Scorpii	2.69	264	17	06.42	50.290	0.000	-14	00	39.82	-0.500	-0.031
645	6461	β Arae	2.85	264	28	41.62	50.290	-0.008	-32	16	03.53	-0.490	-0.026
658	6561	ξ Serpentis	3.54	264	49	05.76	50.260	-0.040	+7	55	54.62	-0.530	-0.060
652	6527	λ Scorpii*	1.63	264	51	29.44	50.290	0.000	-13	47	28.16	-0.500	-0.029
671	6688	ξ Draconis	3.75	265	01	50.10	50.820	+0.525	+80	16	49.42	-0.380	+0.085
651	6510	α Arae	2.95	265	12	23.63	50.270	-0.030	-26	33	48.82	-0.540	-0.072
667	6623	μ Herculis	3.42	265	29	40.45	49.840	-0.452	+51	05	49.75	-1.230	-0.762
665	6603	β Ophiuchi	2.77	265	36	32.01	50.240	-0.051	+27	56	16.89	-0.310	+0.158
648	6500	δ Arae	3.62	265	49	43.37	50.230	-0.067	-37	21	32.43	-0.570	-0.100
654	6553	θ Scorpii	1.87	265	52	19.20	50.310	+0.016	-19	38	51.67	-0.470	-0.001
660	6580	κ Scorpii	2.41	266	44	30.72	50.300	-0.005	-15	38	49.47	-0.490	-0.027
668	6629	γ Ophiuchi	3.75	266	54	17.32	50.260	-0.023	+26	06	29.63	-0.550	-0.074
666	6615	ι^1 Scorpii	3.03	267	47	41.91	50.300	0.000	-16	43	01.35	-0.480	-0.008
669	6630	*G* Scorpii	3.21	268	11	26.29	50.350	+0.049	-13	37	28.90	-0.430	+0.034
676	6705	γ Draconis	2.23	268	14	25.59	50.170	-0.028	+74	55	10.54	-0.490	-0.020
661	6582	η Pavonis	3.62	268	14	45.04	50.310	-0.017	-41	18	44.91	-0.520	-0.055
672	6695	θ Herculis	3.86	268	44	56.99	50.250	+0.009	+60	40	56.46	-0.460	+0.006
674	6703	ξ Herculis	3.7	269	28	07.11	50.390	+0.139	+52	40	58.79	-0.480	-0.017
673	6698	ν Ophiuchi	3.34	270	01	31.93	50.280	-0.007	+13	39	44.16	-0.590	-0.116
1471	6743	θ Arae	3.66	271	27	44.99	50.310	-0.012	-26	39	42.20	-0.480	-0.014
679	6746	γ Sagittarii	2.99	271	32	00.97	50.250	-0.056	-6	59	40.88	-0.650	-0.185
680	6771	72 Ophiuchi	3.73	272	25	55.80	50.180	-0.070	+32	59	14.16	-0.380	+0.081
681	6779	*o* Herculis	3.83	272	58	06.64	50.220	+0.002	+52	10	53.98	-0.460	+0.009
682	6812	μ Sagittarii	3.86	273	29	09.34	50.300	+0.002	+2	20	22.42	-0.460	+0.001
683	6832	η Sagittarii	3.11	273	53	58.36	50.170	-0.137	-13	22	52.70	-0.620	-0.162
687	6859	δ Sagittarii*	2.7	274	51	12.87	50.340	+0.034	-6	28	29.85	-0.490	-0.029
691	6897	α Telescopii	3.51	275	20	45.87	50.310	-0.021	-22	39	02.37	-0.510	-0.053
689	6879	ε Sagittarii	1.85	275	21	03.02	50.270	-0.045	-11	03	18.03	-0.580	-0.122
688	6869	η Serpentis	3.26	275	56	53.05	49.650	-0.614	+20	25	45.56	-1.140	-0.677
692	6913	λ Sagittarii	2.81	276	35	21.35	50.240	-0.053	-2	08	20.85	-0.640	-0.183
697	6951	θ Coronae Aust.	4.64	276	49	00.44	50.360	+0.031	-19	03	57.42	-0.490	-0.024
1482	6973	α Scuti	3.85	279	17	18.97	50.230	-0.037	+14	54	57.59	-0.760	-0.310
214	1953	γ Mensae	5.19	279	50	24.61	50.820	+1.081	-79	59	18.48	-0.750	+0.239
1487	7039	φ Sagittarii	3.17	280	27	14.79	50.350	+0.053	-3	57	23.39	-0.450	-0.004
1489	7063	β Scuti	4.22	282	39	08.01	50.240	-0.006	+18	11	00.50	-0.470	-0.016
706	7121	σ Sagittarii*	2.02	282	39	28.19	50.310	+0.008	-3	27	08.15	-0.500	-0.055
710	7150	ξ^2 Sagittarii	3.51	283	43	25.29	50.320	+0.032	+1	39	31.43	-0.460	-0.015

* **No. 652 : *Schaula*, Mula.** **No. 706 : *Nunki*, Uttarasadha.**
No. 687 : Purvasadha-1.

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY 2^{d}.875 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude	Annual Variation	Annual Proper Motion	Latitude	Annual Variation	Annual Proper Motion
				° ' "	"	"	° ' "	"	"
1496	7234	τ Sagittarii	3.32	285 06 22.83	50.220	-0.083	-5 05 33.32	-0.680	-0.243
699	7001	α Lyrae	0.03	285 35 23.41	50.490	+0.505	+61 43 54.58	-0.180	+0.256
720	7264	π Sagittarii	2.89	286 31 27.09	50.280	-0.004	+1 26 04.16	-0.470	-0.035
717	7236	λ Aquilae	3.44	287 36 15.51	50.210	-0.029	+17 33 46.52	-0.520	-0.087
754	7665	δ Pavonis	3.56	287 53 34.09	51.630	+1.142	-44 42 34.46	-1.870	-1.444
712	7176	ε Aquilae	4.02	288 31 59.95	50.080	-0.075	+37 33 52.64	-0.490	-0.066
705	7106	β Lyrae	var.	289 09 16.72	50.020	+0.005	+55 58 54.50	-0.430	-0.003
810	8254	ν Octantis	3.76	289 57 42.13	50.400	-0.212	-57 46 58.30	-0.640	-0.217
716	7235	ζ Aquilae	2.99	290 04 03.10	50.130	-0.023	+36 10 58.31	-0.510	-0.094
713	7178	γ Lyrae	3.24	292 11 35.13	49.990	-0.003	+55 00 38.54	-0.410	+0.003
775	7913	β Pavonis	3.42	292 46 02.98	50.460	-0.055	-45 57 24.18	-0.380	+0.028
730	7377	δ Aquilae	3.36	293 54 40.25	50.480	+0.294	+24 48 54.12	-0.370	+0.040
764	7790	α Pavonis	1.94	294 05 26.33	50.430	-0.025	-36 16 13.25	-0.500	-0.087
751	7623	θ^1 Sagittarii	4.37	295 08 34.00	50.360	+0.001	-14 23 17.05	-0.430	-0.027
785	7986	β Indi	3.65	298 03 33.12	50.520	+0.008	-39 09 33.72	-0.420	-0.030
769	7869	α Indi	3.11	299 22 40.15	50.520	+0.078	-27 45 19.84	-0.340	+0.048
1508	7405	α Vulpeculae	4.44	299 46 38.60	49.810	-0.209	+45 51 20.93	-0.460	-0.076
746	7570	η Aquilae	var.	300 42 20.29	50.200	+0.010	+21 31 16.12	-0.390	-0.009
741	7525	γ Aquilae	2.72	301 12 38.11	50.150	+0.020	+31 14 29.35	-0.380	-0.005
11	98	β Hydri	2.8	301 15 40.64	53.540	+2.663	-64 47 50.44	-2.320	-1.951
1513	7488	β Sagittae	4.37	301 28 38.09	50.080	+0.003	+38 12 57.21	-0.410	-0.033
732	7417	β Cygni *p*	3.08	301 31 20.78	49.980	+0.002	+48 57 56.22	-0.380	-0.002
745	7557	α Aquilae*	0.77	302 03 06.37	50.840	+0.697	+29 18 10.30	-0.110	+0.262
749	7602	β Aquilae	3.71	302 41 41.87	50.090	-0.064	+26 39 16.22	-0.850	-0.481
743	7536	δ Sagittae	3.82	303 39 30.32	50.070	+0.011	+38 54 39.08	-0.360	+0.006
761	7754	α^2 Capricorni	3.57	304 07 52.25	50.320	+0.063	+6 55 41.28	-0.370	-0.011
762	7776	β Capricorni	3.08	304 19 11.69	50.310	+0.042	+4 35 11.87	-0.370	-0.008
756	7710	θ Aquilae	3.23	305 35 03.87	50.230	+0.041	+20 19 30.45	-0.360	-0.005
752	7635	γ Sagittae	3.47	307 18 54.52	50.130	+0.090	+39 11 18.14	-0.340	+0.006
1550	8039	γ Microscopii	4.67	308 42 15.66	50.380	0.000	-14 40 01.66	-0.330	+0.006
841	8502	α Tucanae	2.86	309 56 41.86	50.520	-0.120	-45 24 20.13	-0.330	0.000
146	1208	γ Hydri	3.24	310 45 17.84	52.130	+0.537	-76 45 32.88	-0.410	-0.010
781	7950	ε Aquarii	3.77	311 59 43.84	50.270	+0.024	+8 04 42.86	-0.370	-0.042
1547	7990	μ Aquarii	4.73	313 19 49.57	50.280	+0.035	+8 14 17.02	-0.360	-0.041
768	7852	ε Delphini	4.03	314 19 56.83	50.110	+0.007	+29 04 16.89	-0.330	-0.024
726	7328	κ Cygni	3.77	315 11 09.92	49.460	+0.396	+73 48 03.82	-0.220	+0.080
829	8425	α Gruis	1.74	316 10 51.86	50.600	+0.064	-32 54 57.35	-0.490	-0.191
(771)	7882	β Delphini m*	3.64	316 36 46.43	50.140	+0.070	+31 54 57.56	-0.360	-0.069
806	8204	ζ Capricorni	3.74	317 12 34.68	50.350	+0.008	-6 59 32.65	-0.270	+0.022
774	7906	α Delphini	3.77	317 39 07.53	50.130	+0.074	+33 01 14.17	-0.310	-0.022
822	8353	γ Gruis	3.01	317 41 35.20	50.550	+0.095	-23 03 07.80	-0.340	-0.058

* **No. 745 : *Altair*, Sravana.** **No. 771 : *Rotanev*, Dhanistha-1.**

Annual rate of Precession in longitude for the middle of the year = 50".29

LONGITUDE AND LATITUDE OF STARS, 2019.5

MEAN PLACES FOR JULY 2^{d}.875 TERRESTRIAL TIME

Cat. No. FK5	BS= HR No.	Star	Mag.	Longitude			Annual Variation	Annual Proper Motion	Latitude			Annual Variation	Annual Proper Motion
				°	'	"	"	"	°	'	"	"	"
733	7420	ι Cygni	3.79	318	14	10.50	49.430	+0.252	+71	27	00.36	-0.180	+0.104
778	7928	δ Delphini	4.43	318	23	13.99	50.030	-0.037	+31	56	30.84	-0.320	-0.035
1541	7948	γ Delphini sq	4.27	319	38	20.50	49.940	-0.109	+32	41	59.50	-0.450	-0.177
860	8675	ε Gruis	3.49	321	00	16.39	50.700	+0.077	-39	47	23.50	-0.380	-0.115
846	8556	δ^{1} Gruis	3.97	321	52	34.89	50.560	+0.027	-31	20	56.15	-0.280	-0.017
812	8278	γ Capricorni	3.68	322	03	51.23	50.490	+0.172	-2	33	32.97	-0.340	-0.084
856	8636	β Gruis	2.11v	322	36	07.40	50.720	+0.145	-35	26	01.97	-0.320	-0.071
800	8131	α Equulei	3.92	323	23	20.53	50.180	+0.029	+20	07	11.81	-0.350	-0.102
808	8232	β Aquarii	2.91	323	40	02.19	50.250	+0.017	+8	36	48.92	-0.260	-0.015
819	8322	δ Capricorni	2.87	323	48	57.22	50.460	+0.149	-2	36	18.02	-0.610	-0.368
1569	8264	ξ Aquarii	4.69	324	23	28.59	50.360	+0.103	+5	57	21.73	-0.300	-0.062
765	7796	γ Cygni	2.2	325	06	38.06	49.670	+0.007	+57	07	23.31	-0.240	-0.001
780	7949	ε Cygni	2.46	328	01	09.13	50.510	+0.705	+49	25	18.95	-0.060	+0.155
815	8308	ε Pegasi	var.	332	09	23.62	50.150	+0.031	+22	05	55.67	-0.190	-0.011
849	8592	ν Aquarii	5.2	332	48	58.05	50.530	+0.154	-10	54	11.16	-0.400	-0.218
797	8115	ζ Cygni	3.2	333	18	41.12	49.850	-0.031	+43	41	36.61	-0.220	-0.051
827	8414	α Aquarii	2.96	333	51	23.04	50.230	+0.015	+11	15	30.17	-0.180	-0.016
867	8728	α PsA	1.16	334	08	05.97	50.710	+0.253	-21	08	17.20	-0.460	-0.287
777	7924	α Cygni	1.25	335	35	51.21	49.540	+0.007	+59	54	19.14	-0.150	+0.001
842	8518	γ Aquarii	3.84	336	59	12.47	50.360	+0.126	+8	14	02.87	-0.180	-0.042
834	8450	θ Pegasi	3.53	337	06	22.70	50.440	+0.278	+16	20	21.85	-0.220	-0.077
861	8679	τ Aquarii	4.01	338	52	05.80	50.310	-0.026	-5	39	55.44	-0.160	-0.030
866	8709	δ Aquarii	3.27	339	08	45.60	50.310	-0.047	-8	11	31.53	-0.130	-0.008
3	25	ε Phoenicis	3.88	339	55	22.00	50.710	+0.011	-41	57	28.54	-0.340	-0.220
850	8597	η Aquarii	4.02	340	45	52.35	50.290	+0.064	+8	21	49.08	-0.200	-0.087
792	8079	ξ Cygni	3.72	341	04	05.75	49.620	+0.014	+56	34	53.01	-0.110	-0.003
864	8698	λ Aquarii*	3.74	341	50	55.17	50.330	+0.025	+0	23	13.38	-0.070	+0.030
72	591	α Hydri	2.86	342	23	52.55	51.660	+0.419	-64	14	37.56	-0.300	-0.194
831	8430	ι Pegasi	3.76	344	40	52.52	50.320	+0.339	+34	15	15.97	-0.190	-0.104
54	472	α Eridani	0.46	345	35	18.53	51.160	+0.084	-59	22	44.59	-0.170	-0.092
12	99	α Phoenicis	2.39	345	46	04.96	50.650	-0.042	-40	38	09.31	-0.520	-0.444
855	8634	ζ Pegasi	3.4	346	25	25.16	50.220	+0.072	+17	40	43.73	-0.120	-0.043
141	1175	β Reticuli	3.85	351	40	54.57	52.970	+0.795	-76	05	22.66	-0.280	-0.260
878	8852	γ Piscium	3.69	351	43	45.07	50.950	+0.713	+7	15	19.42	-0.320	-0.285
871	8781	α Pegasi	2.49	353	45	26.52	50.170	+0.043	+19	24	20.14	-0.080	-0.065
1044	440	δ Phoenicis	3.95	353	53	58.71	51.240	+0.337	-52	34	57.08	+0.020	+0.035
862	8684	μ Pegasi	3.48	354	39	27.47	50.170	+0.130	+29	23	10.68	-0.100	-0.102
857	8650	η Pegasi	2.94	355	59	02.04	49.970	+0.002	+35	06	29.00	-0.020	-0.029
68	566	χ Eridani	3.7	356	31	50.76	52.330	+1.308	-57	01	06.60	-0.200	-0.210
49	429	γ Phoenicis	3.41	358	25	03.78	50.620	-0.186	-47	35	08.92	-0.140	-0.167
870	8775	β Pegasi*	2.42v	359	38	47.61	50.280	+0.270	+31	08	27.33	+0.080	+0.037

* **No. 864 : Satabhisaj.** **No. 870 : *Scheat*, Purva Bhadrapada-2.**

BS = Bright Star Catalogue HR = Havard Revised Catalogue FK5 = Fifth Fundamental Catalogue

MEAN PLACES OF STARS, J 2019.5

FOR JULY $2^{d}.875$ TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension	Annual Variation	Annual Proper motion	Declination	Annual Variation	Annual Proper motion
					h m s	s	s (0.0001)	° ' "	"	" (0.001)
1	15	α Andromedae*	2.06	B9 II	0 09 24.0	3.116	+104	+29 11 52.93	+19.86	-163
2	21	β Cassiopeiae*	2.27	F2 IV	0 10 13.8	3.244	+685	+59 15 26.12	19.84	-181
3	25	ε Phoenicis	3.88	K0 III	0 10 23.7	3.025	+118	-45 38 23.86	19.84	-181
7	39	γ Pegasi*	2.83	B2 IV	0 14 14.5	3.098	+2	+15 17 30.69	19.99	-12
9	74	ι Ceti	3.56	K1.5 III	0 20 25.3	3.056	-9	-8 42 57.50	19.93	-36
11	98	β Hydri	2.8	G0V	0 26 44.9	3.057	+6636	-77 08 40.83	20.23	+324
12	99	α Phoenicis	2.39	K0.5 III b	0 27 14.6	2.950	+183	-42 12 01.36	+19.50	-396
17	153	ζ Cassiopeiae	3.66	B2 IV	0 38 04.1	3.382	+22	+54 00 14.34	19.76	-9
20	165	δ Andromedae	3.27	K3 III	0 40 22.6	3.226	+106	+30 58 02.58	19.64	-92
21	168	α Cassiopeiae*	2.23	K0- IIIa	0 41 37.6	3.448	+64	+56 38 38.40	19.68	-32
22	188	β Ceti*	2.04	K0III	0 44 34.0	3.008	+164	-17 52 47.57	19.70	+32
33	269	μ Andromedae	3.87	A5 V	0 57 50.6	3.355	+130	+38 36 16.91	19.44	+33
32	264	γ Cassiopeiae*	2.47	B0 IVpe	0 57 54.1	3.677	+36	+60 49 18.76	+19.40	-5
35	280	α Sculptoris	4.31	B7IIIp	0 59 32.6	2.885	+17	-29 15 08.91	19.37	+4
40	334	η Ceti	3.45	K1 III	1 09 34.3	3.019	+147	-10 04 45.66	18.99	-138
42	337	β Andromedae*	2.06	M0III	1 10 49.8	3.382	+146	+35 43 24.33	18.98	-114
1033	361	ζ Piscium*	5.24	A7IV	1 14 45.2	3.143	+97	+7 40 40.57	18.93	-56
47	402	θ Ceti	3.6	K0 III	1 24 59.9	3.001	-53	-8 05 00.00	18.46	-218
48	403	δ Cassiopeiae	2.68	A5 III-IVv	1 27 06.5	3.986	+400	+60 20 09.30	+18.56	-52
49	429	γ Phoenicis	3.41	Mo- IIIa	1 29 12.6	2.598	-13	-43 13 07.87	18.33	-208
1044	440	δ Phoenicis	3.95	G9 III	1 32 03.7	2.489	+144	-48 58 18.84	18.60	+151
50	437	η Piscium	3.62	G7 IIa	1 32 31.8	3.222	+19	+15 26 44.45	18.42	-6
54	472	α Eridani*	0.46	B6Vep	1 38 26.3	2.226	+117	-57 08 17.28	18.19	-35
52	464	51 Andromedae	3.57	K3 III	1 39 12.0	3.720	+65	+48 43 34.55	18.08	-113
59	509	τ Ceti	3.5	G8.5 V	1 44 58.5	2.789	-1190	-15 50 07.30	+18.83	+858
62	539	ζ Ceti	3.73	K0 III	1 52 25.4	2.964	+28	-10 14 21.84	17.64	-39
64	544	α Trianguli	3.41	F5III	1 54 11.9	3.440	+9	+29 40 22.99	17.37	-235
66	553	β Arietis*	2.64	A5 V	1 55 43.3	3.329	+68	+20 54 09.15	17.43	-111
63	542	ε Cassiopeiae	3.38	B3III	1 55 49.2	4.393	+48	+63 45 54.43	17.52	-21
68	566	χ Eridani	3.7	G8IV	1 56 42.9	2.329	+730	-51 30 44.76	17.79	+291
72	591	α Hydri	2.86	F0IV	1 59 23.0	1.889	+369	-61 28 31.66	+17.41	+26
71	585	ν Ceti	4	F7III	2 00 55.4	2.827	+97	-20 59 02.60	17.29	-24
73	603	γ Andromed.* p	2.26	K3- IIB	2 05 06.3	3.713	+40	+42 25 20.54	17.08	-52
70	580	50 Cassiopeiae	3.98	A2V	2 05 08.4	5.268	-99	+72 30 51.88	17.15	+22
74	617	α Arietis*	2	K2 III	2 08 16.6	3.398	+138	+23 33 13.45	16.83	-149
75	622	β Trianguli	3	A5 III	2 10 42.7	3.594	+122	+35 04 42.95	16.83	-40
82	674	φ Eridani	3.56	B8IV- V	2 17 12.4	2.142	+102	-51 25 21.38	+16.53	-27
79	664	γ Trianguli	4.01	A1Vnn	2 18 28.8	3.590	+38	+33 56 11.19	16.44	-51
91	779	δ Ceti	4.07	B2 IV	2 40 29.0	3.082	+9	+0 24 41.91	+15.32	-4

* **No. 1 : *Alpheratz*, Uttara Bhadrapada - 2**
No. 2 : *Caph*
No. 7 : *Algenib*, Uttara Bhadrapada - 1
No. 21 : *Schedar* . Mag. 2.1 to 2.6
No. 22 : *Deneb Kaitos or Diphda*
No. 32 : *Cih* . Mag. 1.6 to 3.2
No. 42 : *Mirach*
No. 1033 : Revati
No. 54 : *Achernar*
No. 66 : *Sheratan*, Asvini
No. 73 : *Almach*, Mag. f. 5.1
No. 74 : *Hamal*

MEAN PLACES OF STARS, J 2019.5

FOR JULY $2^d.875$ TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec- tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
1075	794	ι Eridani	4.11	K0III	2	41	26.2	2.367	+120	-39	46	21.93	+15.24	-32
94	801	35 Arietis	4.66	B3 V	2	44	36.1	3.539	+6	+27	47	20.38	15.08	-12
101	841	β Fornacis	4.46	G8 5 IIIb	2	49	54.4	2.512	+71	-32	19	29.65	14.94	+155
100	838	41 Arietis*	3.63	B8 Vn	2	51	08.2	3.550	+50	+27	20	23.02	14.59	-118
99	834	η Persei	3.76	K31b	2	52	08.0	4.428	+20	+55	58	30.03	14.64	-14
907	424	α Ursae Mins.*	2.02	F7:Ib-Iiv	2	56	23.2	84.740	+2134	+89	20	45.62	14.37	-19
103	854	τ Persei	3.95	G4 III+	2	55	39.2	4.298	0	+52	50	27.22	+14.43	-5
104	874	η Eridani	3.89	K1 III	2	57	22.9	2.936	+53	-8	49	17.62	14.11	-220
106	897	θ Eridani* p	3.25	A3 IV-V	2	59	00.1	2.276	-39	-40	13	38.59	14.25	+19
1085	919	τ´ Eridani	4.09	A3IV- V	3	03	15.1	2.647	-105	-23	32	56.10	13.92	-53
107	911	α Ceti*	2.53	M1.5 IIIa	3	03	18.1	3.144	-6	+4	09	54.38	13.89	-78
108	915	γ Persei	2.93	G8 III+	3	06	13.3	4.390	0	+53	34	52.83	13.78	-5
109	921	ρ Persei*	3.39	M4 II	3	06	26.0	3.870	+111	+38	54	52.22	+13.66	-106
111	936	β Persei*	2.12	B8V	3	09	26.7	3.931	+3	+41	01	45.95	13.57	-1
120	1017	α Persei*	1.79	F5 Iab	3	25	43.5	4.320	+25	+49	55	44.45	12.47	-25
121	1030	ο Tauri	3.6	G6 III	3	25	51.9	3.238	-45	+9	05	46.52	12.41	-78
123	1038	ξ Tauri	3.74	B9 Vn	3	28	13.7	3.261	+40	+9	47	57.99	12.28	-39
127	1084	ε Eridani	3.73	K2 Vk	3	33	51.1	2.832	-658	-9	23	35.99	11.95	+23
135	1136	δ Eridani	3.54	B1III-IV	3	44	11.0	2.880	-61	-9	41	54.78	+11.94	+745
131	1122	δ Persei	3.01	B5 III	3	44	19.3	4.303	+28	+47	50	53.71	11.15	-34
141	1175	β Reticuli	3.85	K2 III	3	44	27.0	0.773	+490	-64	44	45.51	11.25	+75
136	1142	17 Tauri	3.7	B6 IIIe	3	46	02.2	3.577	+14	+24	10	23.59	11.01	-46
134	1135	ν Persei	3.77	F5 Iab	3	46	31.5	4.101	-13	+42	38	18.58	11.02	-2
146	1208	γ Hydri	3.24	M2 III	3	46	57.4	-0.856	+116	-74	10	43.90	11.11	+114
139	1165	η Tauri*	2.87	B7 III	3	48	38.9	3.580	+14	+24	09	50.25	+10.82	-46
142	1178	27 Tauri	3.63	B8 III	3	50	19.5	3.581	+13	+24	06	41.69	10.70	-47
144	1203	ζ Persei	2.85	B1 Ib	3	55	21.8	3.789	+4	+31	56	23.93	10.36	-10
149	1231	γ Eridani	2.95	M 1 IIIb	3	58	56.4	2.803	+42	-13	27	15.24	09.99	-112
147	1220	ε Persei	2.89	B 0.5 V+	3	59	10.1	4.048	+16	+40	03	53.82	10.06	-26
148	1228	ξ Persei	4.04	O 7.5 IIIe	4	00	14.1	3.912	+2	+35	50	43.59	10.00	0
150	1239	λ Tauri	3.47v	B3 V+	4	01	45.8	3.333	-4	+12	32	38.60	+09.87	-12
151	1251	ν Tauri	3.91	A0.5 Va	4	04	11.7	3.199	+3	+6	02	31.38	09.70	-3
152	1273	48 Persei	4.04	B3 Ve	4	10	05.1	4.383	+20	+47	45	45.90	09.22	-31
155	1326	α Horologii	3.86	K2 III	4	14	39.0	1.992	+41	-42	14	50.18	08.68	-209
156	1336	α Reticuli	3.35	G8II-III	4	14	40.8	0.789	+65	-62	25	31.43	08.93	+45
159	1346	γ Tauri	3.65	K0III	4	20	54.3	3.424	+80	+15	40	23.55	08.37	-25
162	1373	δ Tauri	3.76	K0III	4	24	03.7	3.470	+75	+17	35	12.14	+08.12	-30
1121	1393	43 Eridani	3.96	K4 III	4	24	46.2	2.257	+56	-33	58	21.44	08.14	+50
164	1409	ε Tauri	3.54	G9.5 III	4	29	45.5	3.513	+76	+19	13	19.56	07.65	-38
171	1465	α Doradus	3.27	A0IIIs	4	34	25.2	1.304	+60	-55	00	19.37	07.31	-4
170	1464	ν´ Eridani	3.82	G8IIIa	4	36	18.6	2.336	-35	-30	31	24.49	+07.14	-12

* **No. 907 : (Nb) : *Polaris*, Dhruva**
No. 100 : Bharani
No. 106 : Acamar.
No. 107 : *Menkar*
No. 109 : Mag. 3.3 to 4.0.
No. 111 : *Algol* , Mag. 2.1 to 3.4.
No. 120 : *Mirphak.*
No. 139 : *Alcyone* , Krittika.

MEAN PLACES OF STARS, J 2019.5

FOR JULY $2^d.875$ TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
168	1457	α Tauri*	0.85	K5III	4	37	02.5	3.451	+44	+16	32	48.98	+06.91	-190
172	1481	53 Eridani	3.87	K1III	4	39	04.5	2.751	-52	-14	16	01.30	06.78	-155
1129	1502	α Caeli	4.45	F2 V	4	41	11.5	1.937	-126	-41	49	38.96	06.68	-77
1134	1543	π^3 Orionis	3.19	F6 V	4	50	54.0	3.263	+313	+6	59	37.68	05.96	+11
179	1552	π^4 Orionis	3.69	B2 III+	4	52	14.8	3.201	-1	+5	38	13.03	05.84	+1
180	1567	π^5 Orionis	3.72	B3 III+	4	55	16.1	3.131	0	+2	28	16.09	05.59	0
178	1542	α Camelopardi	4.29	O9.5 I ae	4	56	00.1	6.011	-1	+66	22	23.07	+05.53	+6
181	1577	ι Aurigae	2.69	K3 II	4	58	16.0	3.918	+3	+33	11	42.63	05.32	-18
183	1605	ε Aurigae*	2.99V	A8 Iab	5	03	22.3	4.320	-1	+43	51	00.50	04.90	-4
1137	1612	ζ Aurigae	3.75	K4Ib-II+	5	03	50.7	4.207	+8	+41	06	08.47	04.84	-22
182	1603	β Camelopardi	4.03	G1Ib-II	5	05	09.7	5.366	-9	+60	28	05.80	04.73	-16
186	1654	ε Leporis	3.19	K4 III	5	06	17.2	2.543	+18	-22	20	45.79	04.58	-74
185	1641	η Aurigae	3.17	B3 V	5	07	53.1	4.220	+26	+41	15	32.07	+04.45	-68
188	1666	β Eridani*	2.79	A3III	5	08	48.6	2.954	-63	-5	03	45.44	04.36	-81
1144	1702	μ Leporis	3.31	B9IV	5	13	48.5	2.698	+30	-16	11	01.51	03.99	-26
194	1713	β Orionis*	0.12	B8 Iab	5	15	28.6	2.887	0	-8	10	49.77	03.87	-1
193	1708	α Aurigae*	0.08	G5IIIe+	5	18	08.0	4.444	+72	+46	00	56.83	03.22	-425
195	1735	τ Orionis	3.6	B5 III	5	18	33.3	2.917	-10	-6	49	28.93	03.60	-8
1147	1765	22 Orionis	4.73	B2IV-V	5	22	45.5	3.067	0	-0	21	53.02	+03.24	-1
201	1790	γ Orionis*	1.64	B2 III	5	26	10.7	3.222	-6	+6	21	56.82	02.93	-14
202	1791	β Tauri*	1.65	B7 III	5	27	31.6	3.799	+17	+28	37	19.49	02.66	-175
204	1829	β Leporis	2.84	G5 II	5	29	04.9	2.574	-3	-20	44	42.55	02.61	-89
214	1953	γ Mensae	5.19	K2 III	5	31	07.2	-2.341	+320	-76	19	33.67	02.80	+282
206	1852	δ Orionis*	2.23	O9.5 II+	5	33	00.2	3.069	+1	-0	17	10.15	02.35	-2
207	1865	α Leporis*	2.58	F0 Ib	5	33	35.5	2.649	+1	-17	48	34.56	+02.31	+2
212	1922	β Doradus	3.76v	F6Ia	5	33	47.8	0.528	+3	-62	28	38.57	02.30	+9
(GC)	1879	λ Orionis*	3.54	O8 III	5	36	12.8	3.308	-1	+9	56	44.34	02.07	-2
209	1899	ι Orionis	2.77	O9 III	5	36	23.3	2.938	0	-5	53	54.58	02.06	+1
210	1903	ε Orionis*	1.7	B0 Iab	5	37	12.2	3.048	+1	-1	11	27.42	01.99	-2
211	1910	ζ Tauri	3	B2IV	5	38	48.7	3.590	0	+21	09	09.72	01.83	-21
215	1956	α Columbae*	2.64	B7 IVe	5	40	21.4	2.176	+5	-34	03	53.46	+01.69	-26
1154	2015	δ Doradus	4.35	A7V	5	44	48.6	0.114	-49	-65	43	41.88	01.34	+8
217	1983	γ Leporis	3.6	F6 V	5	45	16.6	2.503	-212	-22	26	35.73	00.92	-369
219	1998	ζ Leporis	3.55	A2 IV-V(n)	5	47	50.4	2.721	-11	-14	48	57.65	01.06	-1
220	2004	κ Orionis*	2.06	B0Iab	5	48	40.9	2.848	+1	-9	39	50.72	00.99	-2
223	2040	β Columbae	3.12	K1 IIICN+1	5	51	38.9	2.119	+49	-35	45	43.54	01.13	+401
222	2035	δ Leporis	3.81	K1IVFe	5	52	09.6	2.582	+161	-20	52	43.47	+00.04	-649
224	2061	α Orionis*	0.5	M2Iab	5	56	13.7	3.251	+17	+7	24	32.85	+00.34	+9

* **No. 168 : *Aldebaran,* Rohini**
No. 183 : Mag. 2.9 to 3.8.
No. 188 : *Cursa* .
No. 194 : *Rigel.*
No. 193 : *Capella* , Brahmahridaya.
No. 201 : *Bellatrix.*
No. 202 : *El Nath* , Agni.
No. 206 : *Mintaka* .
No. 207 : *Arneb* .
No. GC : *Mrgasiras* .
No. 210 : *Alnilam.*
No. 215 : *Phakt* .
No. 220 : *Saiph* .
No. 224 : *Betelgeuse* , Mag. 0.4 to 1.3 Ardra.

MEAN PLACES OF STARS, J 2019.5

FOR JULY 2^d.875 TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
226	2085	η Leporis	3.71	F2 V	5	57	17.6	2.735	-28	-14	09	55.78	+00.38	+139
229	2120	η Columbae	3.96	K01II	5	59	44.7	1.839	+20	-42	48	54.17	+00.01	-14
227	2088	β Aurigae*	1.9	A2IV+	6	00	57.6	4.404	-54	+44	56	50.37	-00.08	0
225	2077	δ Aurigae*	3.72	K0 III	6	01	08.0	4.943	+92	+54	17	01.94	00.22	-126
1163	2134	1 Geminorum	4.16	G5III	6	05	18.4	3.649	-6	+23	15	38.17	00.56	-100
1168	2219	κ Aurigae	4.35	G8.5IIIb	6	16	37.2	3.823	-57	+29	29	20.58	01.71	-262
240	2282	ζ Canis Maj.	3.02	B2.5V	6	21	03.7	2.306	+7	-30	04	23.44	-01.84	+3
243	2294	β Canis Maj.*	1.98	B1 II/III	6	23	33.5	2.644	-4	-17	58	00.74	02.06	0
241	2286	μ Geminorum	2.88	M3 III	6	24	08.4	3.630	+39	+22	30	06.54	02.22	-111
245	2326	α Carinae*	-0.72	F0II	6	24	23.1	1.333	+25	-52	42	25.24	02.11	+21
244	2298	8ε Monocerotis	4.44	A5 IV	6	24	48.1	3.181	-12	+4	34	53.12	02.15	+11
1173	2343	ν Geminorum	4.15	B6 IIIe	6	30	07.2	3.562	-5	+20	11	53.05	02.64	-14
252	2451	ν Puppis	3.17	B8 III	6	38	21.5	1.838	+2	-43	12	50.23	-03.34	-6
251	2421	γ Geminorum*	1.93	A0 IV	6	38	50.3	3.465	+29	+16	22	51.65	03.42	-42
254	2473	ε Geminorum	2.98	G8 Ib	6	45	07.9	3.689	-4	+25	06	36.19	03.93	-13
257	2491	α Canis Maj* cg	-1.46	A1V	6	46	00.4	2.643	-386	-16	44	38.69	05.20	-1204
256	2484	ξGeminorum	3.36	F5 IV	6	46	23.0	3.366	-79	+12	52	22.65	04.22	-191
262	2550	α Pictoris	3.27	A8VmkA6	6	48	23.4	0.613	-96	-61	57	45.45	03.93	+269
263	2553	τ Puppis	2.93	K1 III	6	50	25.2	1.490	+38	-50	38	18.98	-04.44	-70
1180	2538	κ Canis Maj.	3.96	B1.5IVe	6	50	34.2	2.243	-5	-32	31	55.45	04.38	+4
261	2540	θ Geminorum	3.6	A3III	6	54	04.4	3.949	-2	+33	56	09.21	04.73	-48
268	2618	ε Canis Maj.*	1.5	B2 Iab	6	59	23.6	2.360	+3	-28	59	58.97	05.13	+3
1183	2646	σ Canis Maj.	3.47	M1.5Iab	7	02	29.8	2.392	-4	-27	57	49.97	05.39	+5
270	2653	*o* ˊ Canis Maj.	3.02	B3 Ia	7	03	50.3	2.507	-3	-23	51	46.69	05.51	+3
269	2650	ζ Geminorum*	3.79v	G0Ibv	7	05	15.9	3.555	-6	+20	32	24.14	-05.63	0
1189	2736	γˊ Volantis	3.78	K0III	7	08	34.6	-0.531	+47	-70	31	49.61	05.80	+106
273	2693	δ Canis Maj.	1.86	F8 Iab	7	09	11.1	2.441	-2	-26	25	31.01	05.95	+4
1187	2714	22δ Monocerotis	4.15	A2V	7	12	51.6	3.064	-1	-0	31	35.24	06.26	+5
281	2803	δ Volantis	3.98	F6II	7	16	48.9	-0.048	-12	-67	59	34.50	06.59	+5
278	2773	π Puppis	2.7	K3Ib	7	17	49.9	2.121	-8	-37	08	00.63	06.67	+4
277	2763	λ Geminorum	3.58	A3V	7	19	12.8	3.444	-33	+16	30	13.09	-06.83	-37
279	2777	δ Geminorum	3.53	F0 IV	7	21	17.2	3.578	-19	+21	56	41.25	06.97	-12
283	2827	η Canis Maj.	2.45	B5 Ia	7	24	52.0	2.375	-3	-29	20	31.95	07.25	+5
282	2821	ι Geminorum	3.79	G9 IIIb	7	26	56.1	3.719	-93	+27	45	27.54	07.51	-86
285	2845	β Canis Min.*	2.9	B8Ve	7	28	12.4	3.251	-35	+8	14	54.86	07.56	-38
1194	2878	ρ Puppis	3.25	K5 III	7	29	51.0	1.905	-50	-43	20	30.48	07.47	+187
287	2891	α Gemino.* *cg*	1.95	A2Vm	7	35	50.5	3.820	-135	+31	50	38.86	-08.24	-98
291	2943	α C. Min.* *cg*	0.38	F5 IV-V	7	40	19.3	3.137	-477	+5	10	25.25	09.52	-1022
297	3024	ζ Volantis	3.95	K0III	7	41	34.1	-0.782	+67	-72	39	09.27	-08.58	+18

* **No. 225 : Prajapati.**
No. 227 : *Menkalinam* .
No. 243 : *Mirzam.*
No. 245 : *Canopus* , Agastya.
No. 251 : *Alhena* .

No. 257 : *Sirius* , Lubdhaka Mag. - 1.46.
No. 268 : *Adhara.*
No. 269 : Mekbuda Mag. 3.7 to 4.1.
No. 285 : *Gomeisa.*
No. 287 : *Castor*, Punarvasu-2, Mag. 1.95 & 2.
No. 291 : *Procyon* , Mag. 0.38 & 11.3.

MEAN PLACES OF STARS, J 2019.5

FOR JULY 2^{d}.875 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
293	2970	26α Monocerotis	3.93	G9 III	7	42	10.7	2.867	-49	-9	35	52.38	-08.66	-19
294	2985	κ Geminorum	3.57	G8 III	7	45	37.3	3.614	-24	+24	20	58.79	08.97	-52
295	2990	β Geminorum*	1.14	K0IIIb	7	46	30.4	3.662	-474	+27	58	39.13	09.03	-45
1204	3045	ξ Puppis	3.34	G6 Ia	7	50	06.9	2.525	-2	-24	54	35.36	09.26	-2
301	3080	213 G. Puppis	3.73	K1/2II+	7	52	53.3	2.064	-8	-40	37	37.35	09.47	+3
303	3117	χ Carinae	3.47	B3IVp	7	57	16.4	1.524	-32	-53	02	07.02	09.79	+21
306	3165	ζ Puppis	2.25	O4If(m)p	8	04	16.2	2.111	-24	-40	03	32.59	-10.33	+12
308	3185	ρ Puppis	2.81	F6IIp	8	08	22.5	2.557	-61	-24	21	41.54	10.60	+49
309	3207	γ^2 Velorum	1.78	WC8+O7.5	8	10	08.0	1.850	-4	-47	23	41.54	10.77	+6
312	3249	β Cancri	3.52	K 3:IIIv	8	17	34.3	3.249	-30	+9	07	26.93	11.37	-49
315	3307	ε Carinae	1.86	K2III	8	22	54.7	1.225	-35	-59	34	22.17	11.69	+14
319	3347	β Volantis	3.77	K2 III	8	25	56.6	0.633	-60	-66	12	08.29	12.07	-155
316	3314	Br 1197 Hydrae	3.9	A0V	8	26	38.1	2.996	-44	-3	58	16.27	-11.99	-23
317	3323	ο Ursae Maj.	3.36	G5 III	8	31	52.2	4.930	-182	+60	39	03.99	12.44	-107
321	3366	η Cancri	5.33	K3 III	8	33	50.0	3.461	-34	+20	22	24.99	12.51	-43
1223	3410	δ Hydrae	4.16	A1Vnn	8	38	41.2	3.172	-44	+5	38	04.49	12.80	-7
1224	3418	σ Hydrae	4.44	K1 III	8	39	46.5	3.133	-12	+3	16	18.36	12.89	-18
1227	3447	ο Velorum	3.62	B3 IV	8	40	51.1	1.719	-24	-52	59	30.68	12.92	+20
1226	3445	53 G. Velorum	3.84	F3 Ia	8	41	16.5	1.994	0	-46	43	07.97	-12.96	+3
327	3468	α Pyxidis	3.68	B1.5 III	8	44	22.6	2.414	-9	-33	15	27.19	13.16	+11
1228	3449	γ Cancri	4.66	A1IV	8	44	24.7	3.462	-76	+21	23	49.54	13.21	-39
326	3461	δ Cancri*	3.94	K0 III	8	45	47.4	3.401	-13	+18	04	53.01	13.49	-228
(329)	3482	ε Hydrae* m	3.38	G5III	8	47	48.3	3.170	-155	+6	20	46.32	13.44	-40
328	3475	ι Cancri	4.02	G8Iab	8	47	52.4	3.617	-19	+28	41	14.25	13.44	-42
336	3571	108 G. Carinae	3.84	B8.5II	8	55	29.3	1.355	-28	-60	43	10.58	-13.85	+38
334	3547	ζ Hydrae	3.11	G9 II-III	8	56	25.4	3.167	-66	+5	52	12.79	13.93	+15
337	3572	α Cancri*	4.25	A5 m	8	59	33.1	3.275	+23	+11	46	52.01	14.17	-31
335	3569	ι Ursae Maj.	3.14	A7 V	9	00	32.0	4.077	-443	+47	57	49.49	14.43	-226
342	3614	97 G. Velorum	3.75	K2 III	9	04	49.7	2.073	-44	-47	10	33.97	14.48	-13
341	3594	κ Ursae Maj.	3.6	A1Vn	9	04	56.9	4.066	-32	+47	04	41.03	14.53	-54
345	3634	λ Velorum	2.21	K4 Ib-II	9	08	42.9	2.211	-17	-43	30	43.38	-14.69	+13
1239	3627	ξ Cancri	5.14	G9 III	9	10	28.6	3.439	+1	+21	57	55.60	14.80	+5
348	3685	β Carinae	1.68	A2IV	9	13	24.3	0.631	-311	-69	47	51.76	14.87	+108
347	3665	θ Hydrae	3.88	B9.5 V	9	15	22.7	3.118	+86	+2	13	51.49	15.40	-310
351	3699	ι Carinae	2.25	A8 Ib	9	17	36.7	1.605	-26	-59	21	27.35	15.21	+8
352	3705	α Lyncis	3.13	K7 III	9	22	14.3	3.637	-179	+34	18	32.37	15.46	+19
1243	3718	θ Pyxidis	4.72	M0 III	9	22	21.5	2.660	-8	-26	02	57.32	-15.49	-8
353	3734	κ Velorum*	2.5	B2 IV-V	9	22	43.1	1.861	-10	-55	05	40.45	15.50	+9
354	3748	α Hydrae*	1.98	K3 II-III	9	28	32.7	2.948	-9	-8	44	38.55	15.79	+33
361	3803	N Velorum	3.13	K5 III	9	31	48.9	1.826	-39	-57	07	15.40	15.99	+4
355	3757	23 Ursae Maj.	3.67	F0 IV	9	33	02.7	4.658	+160	+62	58	30.82	16.03	+27
358	3775	θ Ursae Maj.	3.17	F7V	9	34	09.0	3.974	-1024	+51	35	14.37	16.65	-530

* **No. 295 : *Pollux*, Punarvasu-1.**
No. 326 : Pusya.
No. 329 : Aslesa.
No. 337 : Acubens. (Aslesa.)
No. 353 : *Markeb* .
No. 354 : *Alphard* .

MEAN PLACES OF STARS, J 2019.5

FOR JULY $2^d.875$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
1250	3845	ι Hydrae	3.91	K2.5 III	9	40	51.1	3.062	+32	-1	13	56.11	-16.52	-64
364	3849	κ Hydrae	5.06	B4IV/V	9	41	14.5	2.878	-19	-14	25	17.68	16.50	-20
365	3852	ο Leonis	3.52	F5I+	9	42	11.4	3.196	-96	+9	48	09.81	16.56	-37
367	3873	ε Leonis	2.98	G1 II	9	46	57.3	3.393	-34	+23	41	00.71	16.77	-11
368	3888	ν Ursae Maj.	3.8	F2 IV	9	52	21.6	4.210	-379	+58	56	45.36	17.16	-151
371	3905	μ Leonis	3.88	K2 III	9	53	52.1	3.399	-160	+25	54	51.21	17.14	-56
375	3940	φVelorum	3.54	B5 Ib	9	57	33.0	2.115	-12	-54	39	40.15	-17.25	+3
1261	3970	ν² Hydrae	4.6	B8 V	10	06	04.5	2.924	-25	-13	09	35.64	17.60	+18
379	3975	η Leonis	3.52	A0 Ib	10	08	23.6	3.262	-1	+16	40	00.56	17.71	0
380	3982	α Leonis*	1.35	B7 V	10	09	24.5	3.189	-169	+11	52	16.23	17.75	+7
381	3994	λ Hydrae	3.61	K0IIICN+1	10	11	32.4	2.927	-138	-12	27	03.94	17.93	-88
385	4037	ω Carinae	3.32	B8 IIIe	10	14	11.9	1.421	-76	-70	08	06.17	17.94	+7
382	4023	191 G.Velorum	3.85	A2 Va	10	15	33.5	2.529	-131	-42	13	09.09	-17.95	+45
1264	4050	187 G. Carinae	3.4	K3 II a	10	17	44.2	2.013	-34	-61	25	48.60	18.07	+5
384	4031	ζ Leonis	3.44	F0 III	10	17	46.3	3.325	+13	+23	19	09.94	18.09	-7
383	4033	λ Ursae Maj.	3.45	A2 IV	10	18	15.9	3.592	-149	+42	48	58.56	18.14	-38
1268	4080	204 G.Velorum	4.83	K1 III	10	23	10.0	2.584	-20	-41	44	55.29	18.22	+56
386	4069	μ Ursae Maj.	3.05	M0 III	10	23	29.0	3.550	-72	+41	24	02.66	18.26	+35
391	4102	I Carinae	4	F3 V	10	24	46.6	1.173	-52	-74	07	51.75	-18.36	-26
389	4094	μ Hydrae	3.81	K4III	10	27	02.1	2.906	-89	-16	56	11.20	18.49	-80
392	4104	α Antliae	4.25	K4 III	10	28	02.8	2.754	-58	-31	10	03.39	18.44	+11
393	4114	196 G. Carinae	3.82	F2II	10	28	35.9	2.216	-17	-58	50	22.02	18.47	0
1270	4116	δ Sextantis	5.21	B9.5 V	10	30	28.1	3.047	-32	-2	50	22.17	18.55	-14
397	4140	203 G. Carinae	3.32	B4 Vne	10	32	43.3	2.147	-27	-61	47	09.75	18.60	+9
396	4133	ρ Leonis	3.85	B1 Iab	10	33	50.2	3.154	-4	+9	12	20.40	-18.64	-3
401	4174	γ Chamaeleontis	4.11	M0 III	10	35	41.0	0.654	-143	-78	42	32.30	18.69	+14
406	4199	θ Carinae	2.76	B0Vp	10	43	39.4	2.156	-35	-64	29	49.03	18.93	+10
411	4234	δ² Chamaeleontis	4.45	B2.5 IV	10	45	56.4	0.480	-200	-80	38	35.05	19.00	+8
410	4232	ν Hydrae	3.11	K0/K1III	10	50	35.3	2.965	+66	-16	17	46.15	18.93	+200
412	4247	46 Leonis Min.	3.83	K0IIIV	10	54	23.8	3.338	+70	+34	06	33.45	19.50	-279
1283	4287	α Crateris	4.08	K1III	11	00	43.6	2.929	-323	-18	24	10.73	-19.24	+130
416	4295	β Ursae Maj.*	2.37	A1V	11	03	00.4	3.578	+99	+56	16	38.76	19.39	+34
417	4301	α Ursae Maj.*	1.8	K0 Iab	11	04	54.9	3.648	-167	+61	38	42.58	19.53	-66
1289	4337	260 G. Carinae	3.91	G0Iab	11	09	25.7	2.586	-9	-59	04	51.43	19.56	0
420	4335	ψ Ursae Maj.	3.01	K1 III	11	10	45.2	3.348	-60	+44	23	32.42	19.61	-28
422	4357	δ Leonis*	2.56	A4V	11	15	08.6	3.182	+101	+20	24	59.58	19.79	-130
423	4359	θ Leonis*	3.34	A2V	11	15	15.7	3.142	-42	+15	19	21.60	-19.74	-79
425	4377	ν Ursae Maj.	3.48	K3 III	11	19	31.7	3.226	-20	+32	59	15.41	19.70	+28
426	4382	δ Crateris	3.56	K0III	11	20	19.1	3.006	-84	-14	53	03.62	19.53	+208
433	4434	λ Draconis	3.84	M0 III	11	32	32.5	3.489	-73	+69	13	23.63	19.91	-17
434	4450	ξ Hydrae	3.54	G7 III	11	33	57.9	2.965	-162	-31	57	56.49	19.95	-39
436	4467	λ Centauri	3.13	B9III	11	36	41.4	2.802	-61	-63	07	40.14	-19.94	-5

* **No. 380 : *Regulus* , Magha.**
No. 416 : *Merak* , Pulaha.
No. 417 : *Dubhe* , Kratu.
No. 422 : *Zosma* , Purva Phalguni-1.
No. 423 : Purva Phalguni-2.

MEAN PLACES OF STARS, J 2019.5

FOR JULY 2^{d}.875 TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
442	4520	λ Muscae	3.64	A7 V	11	46	32.3	2.875	-174	-66	50	12.85	-19.97	+37
441	4518	χ Ursae Maj.	3.71	K0.5 IIIb	11	47	04.4	3.144	-136	+47	40	16.32	19.98	+30
1304	4527	93 Leonis*	4.53v	A7V+	11	48	59.4	3.088	-106	+20	06	37.72	20.02	-3
444	4534	β Leonis*	2.14	A3 V	11	50	03.2	3.056	-342	+14	27	46.71	20.14	-114
445	4540	β Virginis	3.61	F9 V	11	51	42.7	3.126	+495	+1	39	17.04	20.30	-271
447	4554	γ Ursae Maj.*	2.44	A0 Ve	11	54	50.9	3.127	+107	+53	35	10.65	20.02	+12
452	4621	δ Centauri	2.6	B2 IV ne	12	09	22.6	3.139	-36	-50	49	51.44	-20.03	-8
453	4630	ε Corvi	3	K2III	12	11	07.9	3.097	-51	-22	43	41.29	20.00	+13
455	4656	δ Crucis	2.8	B2 IV	12	16	11.5	3.226	-53	-58	51	26.16	20.00	-9
456	4660	δ Ursae Maj.*	3.31	A3 V	12	16	23.0	2.941	+127	+56	55	27.72	19.98	+9
457	4662	γ Corvi*	2.59	B8III	12	16	48.7	3.095	-112	-17	39	00.35	19.96	+23
459	4674	β Chamaeleontis	4.26	B5 Vn	12	19	31.8	3.667	-174	-79	25	13.08	19.95	+17
460	4689	η Virginis	3.89	A2 IV+	12	20	54.3	3.073	-42	-0	46	30.14	-19.98	-18
462	4730	α Crucis*A	1.33	B0.5 IV	12	27	41.8	3.389	-53	-63	12	24.90	19.91	-12
465	4757	δ Corvi*	2.95	A0IV(m)kB9	12	30	52.6	3.114	-146	-16	37	25.66	20.00	-138
468	4763	γ Crucis	1.63v	M3.5 III	12	32	15.5	3.369	+29	-57	13	19.70	20.11	-262
469	4773	γ Muscae	3.87	B5V	12	33	39.3	3.673	-126	-72	14	25.45	19.83	-2
472	4787	κ Draconis	3.87v	B6IIIp	12	34	18.3	2.526	-112	+69	40	51.29	19.81	+12
471	4786	β Corvi	2.65	G5 II	12	35	24.9	3.165	+2	-23	30	15.66	-19.86	-54
474	4798	α Muscae	2.69	B2 IV-V	12	38	22.0	3.654	-90	-69	14	33.73	19.77	-13
475	4813	χ Virginis	4.66	K2 III	12	40	15.3	3.103	-51	-8	06	09.67	19.76	-25
1326	4828	ρ Virginis	4.88	A0 V	12	42	52.3	3.037	+57	+10	07	42.21	19.78	-90
481	4853	β Crucis	1.25	B0.5 IV	12	48	52.4	3.555	-63	-59	47	41.90	19.60	-14
483	4905	ε Ursae Maj.*	1.77	A0p	12	54	52.9	2.621	+132	+55	51	15.51	19.48	-6
484	4910	δ Virginis*	3.38	M3III	12	56	35.2	3.025	-313	+3	17	30.52	-19.49	-54
485	4915	α CVn sq*	2.9	A0spe	12	56	56.2	2.797	-198	+38	12	48.30	19.37	+56
488	4932	ε Virginis*	2.83	G8 III	13	03	08.9	2.987	-185	+10	51	16.96	19.27	+20
487	4923	δ Muscae	3.62	K2 III	13	03	38.5	4.234	+543	-71	39	12.45	19.29	-20
492	4983	β Com	4.26	G0 V	13	12	46.9	2.795	-604	+27	46	47.06	18.16	+881
495	5020	γ Hydrae	3	G8 III	13	19	59.1	3.277	+47	-23	16	26.10	18.88	-45
496	5028	ι Centauri	2.75	kA15hA3nA3va	13	21	42.0	3.396	-284	-36	48	52.57	-18.87	-86
497	5054	ζ Ursae Maj.*pr	2.27	A2V	13	24	42.5	2.405	+141	+54	49	26.32	18.71	-20
498	5056	α Virginis*	0.98	B1 III-IV+	13	26	13.4	3.170	-28	-11	15	45.07	18.67	-28
501	5107	ζ Virginis	3.37	A3V	13	35	41.3	3.063	-190	-0	41	42.17	18.28	+42
504	5132	ε Centauri	2.3	B1 III	13	41	08.1	3.845	-32	-53	33	53.15	18.14	-17
509	5191	η Ursae Maj.*	1.86	B3 V	13	48	18.4	2.358	-125	+49	12	59.45	17.86	-11
508	5193	μ Centauri	3.04	B2Vmpe	13	50	48.0	3.644	-21	-42	34	12.42	-17.76	-20
513	5235	η Bootis	2.68	G0 IV	13	55	36.8	2.857	-44	+18	18	02.21	17.90	-358
512	5231	ζ Centauri	2.55	B2.5 IV	13	56	46.0	3.778	-56	-47	23	00.64	-17.54	-42

* **No. 1304 : Uttara Phalguni-2.**
No. 444 : *Denebola,* Uttara Phalguni-1.
No. 447 : *Phecda or Phad,* Pulastya.
No. 456 : *Megrez,* Atri.
No. 457 : *Minkar.*
No. 462 : *Acrux* .
No. 465 : *Algorel* , Hasta.
No. 483 : *Alioth,* Angira.
No. 484 : Minelauva.
No. 485 : 12 Canum Venaticorum, Mag. *p* 2.9
No. 488 : *Vindemiatrix.*
No. 497 : *Mizar* , Vasista. Mag. *f* . 4.0.
No. 498 : *Spica* , Citra.
No. 509 : *Alkaid, Benetnasch,* Marichi.

MEAN PLACES OF STARS, J 2019.5

FOR JULY $2^d.875$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
521	5291	α Draconis*	3.65	A0 III	14	04	55.1	1.629	-84	+64	16	58.98	-17.12	+18
518	5267	β Centauri*	0.61	B1 III	14	05	13.0	4.296	-43	-60	27	57.71	17.14	-19
519	5287	π Hydrae	3.27	K1III-IV	14	07	29.2	3.435	+33	-26	46	31.63	17.16	-139
520	5288	θ Centauri	2.06	K0 III	14	07	50.2	3.555	-429	-36	27	54.26	17.52	-520
523	5315	κ Virginis	4.19	K2.5 III	14	13	56.3	3.211	+6	-10	21	49.15	16.57	+140
526	5340	α Bootis*	-0.04	K1.5 III	14	16	33.1	2.739	-769	+19	04	53.82	18.59	-2000
525	5338	ι Virginis	4.08	F7IV	14	17	02.4	3.155	-2	-6	05	33.96	-17.00	-432
1371	5359	λ Virginis	4.52	A1V	14	20	10.1	3.258	-11	-13	27	35.90	16.38	+30
531	5404	θ Bootis	4.05	F7 V	14	25	51.6	2.042	-253	+51	45	40.37	16.52	-398
534	5429	ρ Bootis	3.58	K3 III	14	32	40.2	2.585	-77	+30	17	11.74	15.64	+119
535	5435	γ Bootis	3.03	A7 III	14	32	51.8	2.415	-97	+38	13	25.25	15.59	+153
537	5440	η Centauri	2.31	B1.5 IVne	14	36	45.2	3.839	-31	-42	14	32.65	15.57	-35
538	5460	α Centauri* cg	0.00	G +	14	40	56.2	4.127	-4997	-60	54	52.97	-14.61	+692
541	5469	α Lupi	2.3	B1.5 III	14	43	14.2	4.025	-21	-47	28	14.40	15.19	-18
539	5463	α Circini	3.19	A 7VpSrCrEu	14	44	06.3	4.931	-302	-65	03	30.77	15.35	-232
545	5487	μ Virginis	3.88	F2 V	14	44	05.4	3.171	+73	-5	44	31.15	15.44	-316
544	5485	371 G.Cen	4.05	K5 III	14	44	51.4	3.692	-52	-35	15	23.56	15.26	-180
547	5511	109 Virginis	3.72	A0 V	14	47	14.2	3.040	-76	+1	48	41.77	14.96	-27
542	5470	α Apodis	3.83	K2.5 III	14	50	22.4	7.778	-41	-79	07	30.62	-14.77	-16
550	5563	β Ursae Min.*	2.08	K4 III	14	50	40.1	-0.106	-76	+74	04	32.66	14.72	+12
548	5531	α^2Librae*	2.75	A2HA5MA4IV-	14	51	57.6	3.331	-73	-16	07	18.23	14.73	-67
552	5571	β Lupi	2.68	B2 III	14	59	49.1	3.959	-32	-43	12	40.51	14.22	-39
553	5576	κ Centauri	3.13	B2 IV	15	00	26.3	3.931	-17	-42	10	52.44	14.17	-24
555	5602	β Bootis	3.5	G8 IIIa	15	02	40.8	2.261	-36	+40	18	52.01	14.03	-28
556	5603	σ Librae	3.29	M3/M4III	15	05	13.0	3.528	-54	-25	21	26.66	-13.89	-43
559	5652	ι Librae*	4.54	B9IV pSc	15	13	20.2	3.433	-25	-19	51	51.54	13.36	-39
558	5649	ζ Lupi	3.41	G7 III	15	13	41.8	4.350	-122	-52	10	19.06	13.37	-73
563	5681	δ Bootis	3.47	G8 III	15	16	17.4	2.421	+69	+33	14	34.58	13.24	-112
564	5685	β Librae*	2.61	B8 IV	15	18	03.5	3.238	-65	-9	27	13.34	13.03	-19
560	5671	γ Tr. Austrini	2.89	A1 IV	15	20	45.5	5.701	-132	-68	44	58.42	12.86	-31
569	5735	γ Ursae Min.	3.05	A 3 Iab	15	20	42.7	-0.043	-40	+71	45	52.61	-12.81	+20
1402	5695	δ Lupi	3.22	B1.5 IV	15	22	39.6	3.963	-13	-40	43	00.48	12.73	-26
566	5705	φ' Lupi	3.56	K5 III	15	23	03.0	3.829	-74	-36	19	50.71	12.76	-84
571	5744	ι Draconis	3.29	K2 III	15	25	22.0	1.345	-12	+58	53	53.74	12.50	+17
572	5747	β Cr. Borealis	3.68	F0p	15	28	38.0	2.476	-137	+29	02	21.97	12.21	+86
578	5793	α Cr.Borealis*	2.23	A0 V	15	35	30.9	2.543	+91	+26	39	00.26	11.90	-88
577	5787	γ Librae	3.91	K0III	15	36	37.2	3.367	+45	-14	51	11.85	-11.73	+9
579	5794	ν Librae	3.58	K5 III	15	38	12.8	3.658	-7	-28	11	53.58	11.62	+3
1413	5838	κ Librae	4.74	K5III	15	43	04.4	3.469	-26	-19	44	26.54	11.38	-103
582	5854	α Serpentis*	2.65	K2 III b	15	45	13.8	2.960	+92	+6	21	55.74	-11.07	+47

* **No. 518 : *Agena* .**
No. 521 : *Thuban* .
No. 526 : *Arcturus* , Svati.
No. 538 : Rigil *Kentaurus* Mag. 0.33 & 1.70.
No. 548 : *Zuben el Genubi*, Visakha.
No. 550 : *Kochab* .
No. 559 : Visakha.
No. 564 : *Zuben es Chamali.*
No. 578 : *Margarita, Alphecca.*
No. 582 : *Unukalhaly.*

MEAN PLACES OF STARS, J 2019.5

FOR JULY 2^{d}.875 TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec- tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
583	5867	β Serpentis	3.67	A3V	15	47	05.3	2.773	+46	+15	21	42.88	-11.03	-45
585	5881	μ Serpentis	3.54	A0 V	15	50	38.4	3.138	-57	-3	29	19.08	10.75	-24
588	5892	ε Serpentis	3.71	A2 m	15	51	47.4	2.996	+86	+4	25	12.95	10.57	+63
589	5897	β Tr.Australis	2.85	F1V	15	56	52.7	5.348	-283	-63	29	19.40	10.65	-398
591	5933	γ Serpentis	3.85	F6 V	15	57	21.3	2.776	+217	+15	35	56.93	11.50	-1281
592	5944	π Scorpii	2.89	B1 V+	16	00	02.1	3.643	-8	-26	10	07.48	10.04	-26
594	5953	δ Scorpii*	2.32	B0.2 Ive	16	01	29.4	3.560	-8	-22	40	32.54	-09.93	-22
597	5984	β Scorpii*pr	2.62	B0.5 V	16	06	34.4	3.500	-4	-19	51	26.35	09.54	-19
603	6056	δ Ophiuchi	2.74	M0.5 III	16	15	22.2	3.151	-29	-3	44	35.41	08.98	-143
605	6075	ε Ophiuchi	3.24	G9.5 IIIb	16	19	21.3	3.181	+57	-4	44	19.15	08.48	+41
608	6092	τ Herculis	3.89	B5 IV	16	20	19.7	1.808	-11	+46	16	03.87	08.40	+40
607	6084	σ Scorpii	2.89	B1 III	16	22	22.6	3.659	-8	-25	38	16.98	08.30	-21
609	6095	γ Herculis	3.75	B9 III	16	22	46.9	2.650	-33	+19	06	30.51	-08.21	+43
613	6117	ω Herculis	4.57	B9 p	16	26	19.0	2.773	+30	+13	59	22.54	08.03	-59
616	6134	α Scorpii* cg	0.96	M1.5 Iab-b	16	30	36.4	3.690	-7	-26	28	25.10	07.64	-20
618	6148	β Herculis	2.77	G7 III a	16	31	03.6	2.582	-70	+21	26	53.72	07.60	-15
611	6102	γ Apodis	3.89	G8III	16	36	30.1	9.415	-452	-78	56	12.83	07.22	-77
620	6165	τ Scorpii	2.82	B0.2 V	16	37	06.0	3.746	-6	-28	15	17.43	07.11	-22
622	6175	ζ Ophiuchi	2.56	O9V	16	38	14.1	3.311	+9	-10	36	18.40	-06.97	+26
626	6220	η Herculis	3.53	G7 .5IIIb	16	43	33.9	2.060	+32	+38	53	10.21	06.64	-82
625	6217	α Tr. Austr.*	1.92	K2 II-III	16	50	44.7	6.411	+26	-69	03	38.49	06.00	-34
1438	6243	20 Ophiuchi	4.65	F7 V	16	50	54.9	3.326	+65	-10	48	57.63	06.04	-93
628	6241	ε Scorpii	2.29	K1 III	16	51	25.8	3.898	-493	-34	19	36.94	06.16	-257
1435	6229	η Arae	3.76	K5 III	16	51	28.7	5.211	+49	-59	04	26.18	05.93	-28
1439	6247	μ' Scorpii	3.08v	B1.5Vp+	16	53	11.7	4.077	-9	-38	04	44.61	-05.78	-25
633	6299	κ Ophiuchi	3.2	K2 III	16	58	35.5	2.844	-197	+9	20	45.65	05.32	-11
631	6285	ζ Arae	3.13	K3III	17	00	14.4	4.988	-23	-56	01	07.31	05.20	-36
634	6324	ε Herculis	3.92	A0 V	17	01	02.2	2.298	-36	+30	53	55.58	05.07	+28
635	6355	60 Herculis	4.91	A4 IV	17	06	17.0	2.786	+35	+12	42	55.32	04.66	-10
639	6396	ζ Draconis	3.17	B6 III	17	08	50.8	0.188	-33	+65	41	26.66	04.41	+22
638	6380	η Scorpii	3.33	F5IV	17	13	33.2	4.309	+23	-43	15	46.41	-04.32	-287
643	6418	π Herculis	3.16	K3 Ib	17	15	43.6	2.093	-22	+36	47	17.48	03.84	+4
641	6410	δ Herculis	3.14	A3IV	17	15	50.0	2.467	-15	+24	49	02.59	04.00	-157
644	6453	θ Ophiuchi	3.27	B2 IV	17	23	12.5	3.691	-3	-25	01	02.12	03.22	-20
645	6461	β Arae	2.85	K3 Ib-II	17	26	55.5	5.002	-10	-55	32	45.68	02.91	-25
1457	6486	44 Ophiuchi	4.17	kA5hA9mF1III	17	27	33.8	3.670	0	-24	11	29.54	02.94	-116
653	6536	β Draconis	2.79	G2Iab	17	30	52.5	1.360	-17	+52	17	15.50	-02.53	+15
649	6508	υ Scorpii	2.69	B2 IV	17	32	05.5	4.086	-1	-37	18	34.23	02.47	-31
648	6500	δ Arae	3.62	B8 Vn	17	32	51.8	5.431	-80	-60	41	51.23	02.46	-96
651	6510	α Arae	2.95	B2 Vne	17	33	21.1	4.648	-32	-49	53	22.28	02.40	-70
652	6527	λ Scorpii*	1.63	B2 IV+	17	34	56.1	4.080	-1	-37	06	58.07	02.22	-29
656	6556	α Ophiuchi*	2.08	A5 III	17	35	50.4	2.788	+82	+12	32	49.84	-02.33	-226

* **No. 594 : *Dschubba*, Anuradha**
No. 597 : *Graffias*, Mag. 2.9, 5.1
No. 616 : *Antares*, Jyestha, Mag. 0.9 to 1.8.
No. 625 : *Atria.*
No. 652 : *Schaula*, Mula.
No. 656 : *Ras Alhague.*

MEAN PLACES OF STARS, J 2019.5

FOR JULY 2^{d}.875 TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spectral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
658	6561	ξ Serpentis	3.54	A9IIIpSr	17	38	42.3	3.439	-29	-15	24	33.13	-01.92	-58
654	6553	θ Scorpii	1.87	F1 II	17	38	43.3	4.318	+14	-43	00	29.67	01.86	-2
663	6588	ι Herculis	3.8	B3 IV	17	40	01.0	1.697	-5	+45	59	48.50	01.74	+5
660	6580	κ Scorpii	2.41	B1.5 III	17	43	50.3	4.156	-5	-39	02	17.29	01.44	-27
665	6603	β Ophiuchi	2.77	K2 III	17	44	26.2	2.966	-27	+4	33	38.03	01.20	+159
667	6623	μ Herculis	3.42	G5IV	17	47	13.4	2.351	-233	+27	42	37.27	01.87	-752
661	6582	η Pavonis	3.62	K2II	17	47	39.0	5.899	-21	-64	43	49.51	-01.13	-54
668	6629	γ Ophiuchi	3.75	A0 V	17	48	52.3	3.011	-15	+2	42	04.94	01.05	-74
666	6615	ι' Scorpii	3.03	F2 I ae	17	48	57.0	4.200	0	-40	07	57.52	00.97	-8
669	6630	*G* Scorpii	3.21	K2 III	17	51	11.2	4.087	+41	-37	02	51.37	00.74	+33
671	6688	ξ Draconis	3.75	K2 III	17	53	52.0	1.040	+114	+56	52	12.37	00.46	+80
672	6695	θ Herculis	3.86	K1 IIaCn+	17	56	55.3	2.060	+4	+37	14	56.21	00.26	+6
676	6705	γ Draconis*	2.23	K5 III	17	57	03.6	1.396	-8	+51	29	14.43	-00.28	-19
674	6703	ξ Herculis	3.7	G8 III	17	58	31.4	2.334	+64	+29	14	48.97	00.15	-17
673	6698	ν Ophiuchi	3.34	G 9 III	18	00	06.0	3.305	-4	-9	46	28.10	-00.11	-116
677	6714	67 Ophiuchi	3.97	B5 Ib	18	01	37.4	3.007	+1	+2	55	55.37	+00.13	-8
679	6746	γ Sagittarii	2.99	K1III	18	07	03.7	3.855	-41	-30	25	19.33	00.43	-185
1471	6743	θ Arae	3.66	B2 Ib	18	08	08.9	4.671	-10	-50	05	17.25	00.70	-14
680	6771	72 Ophiuchi	3.73	A4IVs	18	08	16.5	2.846	-41	+9	34	04.75	+00.80	+80
681	6779	*o* Herculis	3.83	B9.5V	18	08	18.2	2.342	+1	+28	45	58.70	00.74	+10
682	6812	μ Sagittarii	3.86	B2III	18	14	55.8	3.589	+1	-21	03	07.32	01.31	+1
683	6832	η Sagittarii	3.11	M3.5 III	18	18	56.8	4.059	-106	-36	45	14.26	01.49	-167
695	6927	χ Draconis	3.57	F7 V	18	20	42.2	-1.088	+1199	+72	44	27.10	01.46	-346
687	6859	δ Sagittarii*	2.7	K3IIIa	18	22	14.5	3.840	+27	-29	49	05.06	01.91	-28
688	6869	η Serpentis	3.26	K0 III-IV	18	22	19.2	3.106	-364	-2	53	32.26	+01.25	-701
690	6895	109 Herculis	3.84	K2 III	18	24	31.8	2.559	+141	+21	46	47.41	01.90	-242
689	6879	ε Sagittarii*	1.85	B9.5III	18	25	28.0	3.981	-31	-34	22	24.91	02.10	-124
691	6897	α Telescopii	3.51	B3 IV	18	28	25.1	4.445	-15	-45	57	20.36	02.42	-54
692	6913	λ Sagittarii	2.81	K0IV	18	29	10.4	3.702	-32	-25	24	33.16	02.36	-185
697	6951	θ Coronae Aust.	4.64	G8 III	18	34	53.6	4.280	+28	-42	17	47.42	03.02	-22
1482	6973	α Scuti	3.85	K3 III	18	36	16.1	3.265	-10	-8	13	44.02	+02.85	-312
699	7001	α Lyrae*	0.03	A0 V	18	37	36.0	2.033	+172	+38	48	10.03	03.56	+287
1487	7039	φ Sagittarii	3.17	B8 III	18	46	52.4	3.745	+40	-26	58	08.45	04.07	+1
1489	7063	β Scuti	4.22	G4 IIa	18	48	12.6	3.183	-3	-4	43	31.94	04.17	-16
705	7106	β Lyrae*	3.45	B7 Ve+	18	50	48.0	2.217	+3	+33	23	10.91	04.40	-3
706	7121	σ Sagittarii*	2.02	B2V	18	56	28.4	3.716	+10	-26	16	14.95	04.83	-54
710	7150	ξ^2 Sagittarii	3.51	G9II/III	18	58	53.5	3.576	+24	-21	04	45.83	+05.08	-12
713	7178	γ Lyrae	3.24	B9 III	18	59	40.4	2.246	-2	+32	43	02.48	05.16	+2
712	7176	ε Aquilae	4.02	K1 III	19	00	30.5	2.724	-35	+15	05	45.63	05.16	-73
716	7235	ζ Aquilae	2.99	A0 Vn	19	06	18.4	2.758	-3	+13	53	37.33	05.62	-96
717	7236	λ Aquilae	3.44	B9Vn	19	07	17.0	3.183	-11	-4	51	06.64	05.71	-90
1496	7234	τ Sagittarii	3.32	K1III	19	08	09.4	3.740	-40	-27	38	24.93	+05.62	-251

No. 676 : *Eltanin.*

No. 687 : Purvasadha-1.

No. 689 : *Kaus Australis*, Purvasadha-2.

No. 699 : *Vega*, Abhijit.

No. 705 : Sheliak Mag. 3.3 to 4.3.

No. 706 : *Nunki*, Uttarasadha.

MEAN PLACES OF STARS, J 2019.5

FOR JULY 2^{d}.875 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spec-tral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
720	7264	π Sagittarii	2.89	F2 II/III	19	10	55.3	3.564	0	-20	59	27.67	+06.07	-35
723	7310	δ Draconis	3.07	G9 III	19	12	33.3	-0.003	+164	+67	41	45.05	06.33	+93
726	7328	κ Cygni	3.77	G9 III	19	17	33.2	1.385	+66	+53	24	18.35	06.78	+125
730	7377	δ Aquilae	3.36	F0IV	19	26	28.9	3.024	+171	+3	09	18.00	07.47	+83
1508	7405	α Vulpeculae	4.44	M0III	19	29	31.0	2.498	-92	+24	42	19.75	07.52	-106
733	7420	ι Cygni	3.79	A5V	19	30	11.8	1.511	+22	+51	46	19.28	07.82	+130
732	7417	β Cygni**p*	3.08	K3II+	19	31	30.5	2.421	+2	+28	00	06.11	+07.79	-2
1513	7488	β Sagittae	4.37	G8III a	19	41	55.5	2.695	+7	+17	31	20.59	08.59	-32
741	7525	γ Aquilae	2.72	K3 II	19	47	11.2	2.852	+12	+10	39	43.22	09.03	-2
743	7536	δ Sagittae	3.82	M2 II+	19	48	15.4	2.676	+5	+18	35	00.66	09.13	+8
745	7557	α Aquilae*	0.77	A7 V	19	51	44.1	2.926	+363	+8	55	15.94	09.78	+387
746	7570	η Aquilae	3.90V.	F6Iab	19	53	27.9	3.054	+7	+1	03	25.17	09.51	-7
749	7602	β Aquilae*	3.71	G9.5IV	19	56	16.3	2.946	+33	+6	27	24.06	+09.26	-482
752	7635	γ Sagittae	3.47	M0 III	19	59	37.5	2.669	+46	+19	32	46.47	10.02	+24
751	7623	θ^1 Sagittarii	4.37	B3 IV	20	01	00.1	3.891	+5	-35	13	19.29	10.07	-26
754	7665	δ Pavonis	3.56	G8 IV	20	10	37.2	5.817	+1997	-66	07	47.94	09.69	-1126
756	7710	θ Aquilae	3.23	B9.5 III+	20	12	18.6	3.093	+26	-0	45	44.63	10.94	+4
757	7735	31 o^2 Cygni	3.79	K2II+	20	14	14.8	1.890	+4	+46	48	04.54	11.08	+3
761	7754	α^2 Capricorni*	3.57	G8.5III-IV	20	19	08.1	3.323	+44	-12	28	59.16	+11.44	+4
762	7776	β Capricorni	3.08	K0:II:+	20	22	06.3	3.364	+29	-14	43	06.62	11.65	+2
765	7796	γ Cygni	2.2	F8 I ab	20	22	55.7	2.155	+4	+40	19	11.90	11.70	0
764	7790	α Pavonis	1.94	B2IV	20	27	10.7	4.703	+8	-56	40	15.08	11.91	-89
768	7852	ε Delphini	4.03	B6 III	20	34	08.7	2.866	+9	+11	22	14.25	12.46	-22
(771)	7882	β Delphini*m	3.64	F5 IV	20	38	27.8	2.814	+81	+14	39	49.98	12.73	-48
769	7869	α Indi	3.11	K0 III-IV	20	38	55.8	4.191	+52	-47	13	19.21	+12.88	+66
774	7906	α Delphini*	3.77	B9 IV	20	40	32.6	2.787	+46	+15	58	54.58	12.92	-2
777	7924	α Cygni*	1.25	A2 Iae	20	42	05.8	2.047	+3	+45	21	02.87	13.02	+2
778	7928	δ Delphini	4.43	A7IIIp	20	44	22.2	2.801	-13	+15	08	43.87	13.13	-43
783	7957	η Cephei	3.43	K0 IV	20	45	41.0	1.210	+120	+61	54	53.92	14.08	+819
775	7913	β Pavonis	3.42	A7III	20	46	41.5	5.323	-76	-66	07	52.47	13.34	+11
780	7949	ε Cygni	2.46	K0 III	20	47	00.1	2.430	+286	+34	02	39.06	+13.67	+328
1541	7948	γ Delphini sq	4.27	K1 IV	20	47	33.8	2.784	-22	+16	11	43.97	13.18	-197
781	7950	ε Aquarii	3.77	A1.5V	20	48	43.8	3.242	+24	-9	25	23.64	13.42	-34
1547	7990	μ Aquarii	4.73	A3m	20	53	42.2	3.230	+30	-8	54	32.51	13.75	-30
785	7986	β Indi	3.65	K1 II	20	56	19.1	4.636	+21	-58	22	44.56	13.92	-26
1550	8039	γ Microscopii	4.67	G6III	21	02	28.9	3.663	-2	-32	10	49.20	14.33	+5
792	8079	ξ Cygni	3.72	K4.5 Ib-II	21	05	38.5	2.186	+8	+44	00	22.96	+14.52	+1
797	8115	ζ Cygni	3.2	G8III	21	13	46.0	2.557	+1	+30	18	27.95	14.94	-56
800	8131	α Equulei	3.92	G0III+	21	16	47.9	2.998	+39	+5	19	45.85	15.08	-88
803	8162	α Cephei*	2.44	A7IV	21	19	02.6	1.427	+219	+62	40	07.13	15.35	+50
806	8204	ζ Capricorni	3.74	G4 Ibp	21	27	46.6	3.414	+1	-22	19	33.20	+15.80	+23

* **No. 732 : *Albireo* ., Mag. *f* . 5.4.**
No. 745 : *Altair* , Sravana.
No. 749 : *Alshain* .
No. 761 : Giedi or Algedi.

No. 771 : *Rotanev* , Dhanistha-1.
No. 774 : *Saulocin,* Dhanistha-2.
No. 777 : *Deneb.*
No. 803 : *Alderamin.*

MEAN PLACES OF STARS, J 2019.5

FOR JULY 2^{d}.875 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

Cat. No. FK5	BS =HR No.	Star	Mag.	Spectral Type	Right Ascension			Annual Variation	Annual Proper motion	Declination			Annual Variation	Annual Proper motion
					h	m	s	s	s (0.0001)	°	'	"	"	" (0.001)
809	8238	β Cephei	3.23	B2 IIIev	21	28	54.2	0.747	+21	+70	38	47.54	+15.85	+7
808	8232	β Aquarii*	2.91	G0 Ib	21	32	35.0	3.154	+14	-5	29	04.21	16.03	-8
1569	8264	ξ Aquarii	4.69	A7 V	21	38	47.3	3.188	+78	-7	45	57.25	16.33	-25
812	8278	γ Capricorni	3.68	A7 mp	21	41	10.1	3.315	+132	-16	34	24.10	16.45	-23
810	8254	ν Octantis	3.76	K1 III	21	43	34.3	6.414	+140	-77	18	06.27	16.35	-240
815	8308	ε Pegasi*	2.34	K2 Ib	21	45	08.6	2.947	+21	+9	57	54.55	16.67	-1
819	8322	δ Capricorni	2.87	kA5hF0mF2III	21	48	06.9	3.303	+183	-16	02	16.67	+16.52	-296
822	8353	γ Gruis	3.01	B8III	21	55	06.2	3.611	+86	-37	16	20.32	17.12	-21
827	8414	α Aquarii*	2.96	G2 Ib	22	06	47.1	3.079	+13	-0	13	27.96	17.64	-10
831	8430	ι Pegasi	3.76	F5 V	22	07	55.2	2.799	+220	+25	26	27.45	17.72	+25
829	8425	α Gruis*	1.74	B6V	22	09	27.2	3.749	+126	-46	51	56.78	17.60	-151
834	8450	θ Pegasi	3.53	A1Va	22	11	11.0	3.026	+185	+6	17	40.00	17.85	+27
836	8465	ζ Cephei	3.35	K1.5 Iab	22	11	32.0	2.091	+19	+58	17	52.18	+17.84	+4
841	8502	α Tucanae	2.86	K3 III	22	19	49.3	4.052	-96	-60	09	41.83	18.11	-43
842	8518	γ Aquarii	3.84	A0V	22	22	39.8	3.096	+88	-1	17	18.55	18.27	+7
846	8556	δ' Gruis	3.97	G7III	22	30	25.7	3.559	+26	-43	23	43.25	18.53	-5
848	8585	α Lacertae	3.77	A1 V	22	32	05.9	2.486	+144	+50	22	59.59	18.60	+19
849	8592	v Aquarii	5.2	F7 V	22	35	45.5	3.272	+158	-20	36	27.98	18.56	-144
850	8597	η Aquarii	4.02	B9 IV-V:n	22	36	21.5	3.082	+61	-0	00	59.32	+18.67	-56
855	8634	ζ Pegasi	3.4	B8V	22	42	26.1	2.995	+55	+10	56	00.98	18.89	-12
856	8636	β Gruis	2.1	M5 III	22	43	49.4	3.553	+133	-46	46	55.74	18.94	-8
857	8650	η Pegasi	2.94	G2II-III+	22	43	55.1	2.822	+11	+30	19	25.26	18.92	-25
860	8675	ε Gruis	3.49	A2IVnSB2	22	49	43.4	3.589	+115	-51	12	49.84	19.04	-71
863	8694	ι Cephei	3.52	K0III	22	50	22.8	2.154	-108	+66	18	11.82	19.00	-125
861	8679	τ Aquarii	4.01	K5III	22	50	37.3	3.170	-8	-13	29	21.39	+19.09	-38
862	8684	μ Pegasi	3.48	G8 III	22	50	56.8	2.904	+108	+24	42	17.87	19.10	-42
864	8698	λ Aquarii*	3.74	M2 III	22	53	37.8	3.126	+8	-7	28	31.58	19.24	+37
866	8709	δ Aquarii	3.27	A3 V	22	55	41.0	3.177	-28	-15	43	00.16	19.23	-25
867	8728	α PsA*	1.16	A4 V	22	58	43.5	3.301	+255	-29	31	06.61	19.16	-165
869	8762	*o* Andromedae	3.62	B6III pe+	23	02	49.4	2.776	+20	+42	25	51.91	19.41	-6
870	8775	β Pegasi*	2.42	M2.5 II-III	23	04	43.4	2.919	+143	+28	11	20.10	+19.60	+137
871	8781	α Pegasi*	2.49	B9III	23	05	44.0	2.994	+44	+15	18	37.80	19.44	-42
873	8812	88 Aquarii	3.66	K1III	23	10	29.0	3.190	+40	-21	03	58.47	19.61	+31
878	8852	γ Piscium	3.69	G9 III	23	18	10.6	3.112	+509	+3	23	20.69	19.73	+17
890	8961	λ Andromedae	3.82v	G8 III	23	38	31.5	2.959	+157	+46	33	50.25	19.53	-421
893	8974	γ Cephei	3.21	K1 IV	23	40	09.8	2.523	-212	+77	44	29.04	+20.12	+151
902	9072	ω Piscium	4.01	F4V	0	00	18.9	3.086	+103	+6	58	16.40	+19.93	-115

BS = Bright Star Catalogue HR = Havard Revised Catalogue FK5 = Fifth Fundamental Catalogue

* **No. 808 : *Sadalsuud.***
No. 815 : *Enif*. Mag. 0.7 to 3.5.
No. 827 : *Sadalmelik.*
No. 829 : *Al Nair.*
No. 864 : Satabhisaj.
No. 867 : *Fomalhaut*.
No. 870 : *Scheat*, Purva Bhadrapada-2.
No. 871 : *Markab*, Purva Bhadrapada-1.

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		γ Pegasi						α Phoenicis						β Ceti						β Andromedae					
Mag. Spect.		2.83			B2 IV			2.39			K0 III			2.04			K0 III			2.06			M0 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	0	14	12	+15	17	19	0	27	12	-42	12	31	0	44	32	-17	53	11	1	10	48	+35	43	19
	11	0	14	12	15	17	18	0	27	12	42	12	31	0	44	32	17	53	11	1	10	47	35	43	18
	21	0	14	12	15	17	17	0	27	12	42	12	30	0	44	31	17	53	12	1	10	47	35	43	18
	31	0	14	12	15	17	16	0	27	11	42	12	29	0	44	31	17	53	12	1	10	47	35	43	16
Feb.	10	0	14	12	15	17	15	0	27	11	42	12	28	0	44	31	17	53	12	1	10	47	35	43	15
	20	0	14	12	15	17	14	0	27	11	42	12	26	0	44	31	17	53	11	1	10	47	35	43	14
Mar.	2	0	14	12	+15	17	13	0	27	11	-42	12	24	0	44	31	-17	53	10	1	10	47	+35	43	12
	12	0	14	11	15	17	12	0	27	11	42	12	22	0	44	31	17	53	09	1	10	47	35	43	10
	22	0	14	11	15	17	11	0	27	11	42	12	19	0	44	31	17	53	08	1	10	47	35	43	09
Apr.	1	0	14	12	15	17	11	0	27	11	42	12	16	0	44	31	17	53	06	1	10	47	35	43	07
	11	0	14	12	15	17	11	0	27	11	42	12	13	0	44	31	17	53	04	1	10	47	35	43	06
	21	0	14	12	15	17	11	0	27	11	42	12	10	0	44	31	17	53	02	1	10	47	35	43	05
May	1	0	14	12	+15	17	11	0	27	12	-42	12	07	0	44	31	-17	53	00	1	10	47	+35	43	04
	11	0	14	12	15	17	12	0	27	12	42	12	04	0	44	32	17	52	58	1	10	47	35	43	03
	21	0	14	12	15	17	13	0	27	12	42	12	01	0	44	32	17	52	56	1	10	47	35	43	03
	31	0	14	13	15	17	14	0	27	12	42	11	58	0	44	32	17	52	53	1	10	48	35	43	03
June	10	0	14	13	15	17	16	0	27	13	42	11	56	0	44	32	17	52	51	1	10	48	35	43	04
	20	0	14	13	15	17	18	0	27	13	42	11	54	0	44	33	17	52	49	1	10	48	35	43	05
	30	0	14	14	+15	17	20	0	27	14	-42	11	52	0	44	33	-17	52	47	1	10	49	+35	43	06
July	10	0	14	14	15	17	22	0	27	14	42	11	51	0	44	33	17	52	45	1	10	49	35	43	08
	20	0	14	14	15	17	24	0	27	14	42	11	50	0	44	34	17	52	43	1	10	49	35	43	10
	30	0	14	15	15	17	26	0	27	15	42	11	49	0	44	34	17	52	42	1	10	50	35	43	12
Aug.	9	0	14	15	15	17	28	0	27	15	42	11	49	0	44	34	17	52	41	1	10	50	35	43	14
	19	0	14	15	15	17	30	0	27	15	42	11	50	0	44	34	17	52	40	1	10	50	35	43	17
	29	0	14	15	+15	17	32	0	27	16	-42	11	50	0	44	35	-17	52	40	1	10	51	+35	43	19
Sept.	8	0	14	15	15	17	34	0	27	16	42	11	52	0	44	35	17	52	40	1	10	51	35	43	22
	18	0	14	16	15	17	35	0	27	16	42	11	54	0	44	35	17	52	40	1	10	51	35	43	24
	28	0	14	16	15	17	37	0	27	16	42	11	55	0	44	35	17	52	41	1	10	51	35	43	26
Oct.	8	0	14	16	15	17	38	0	27	16	42	11	58	0	44	35	17	52	42	1	10	51	35	43	29
	18	0	14	16	15	17	39	0	27	16	42	12	00	0	44	35	17	52	43	1	10	51	35	43	30
	28	0	14	16	+15	17	39	0	27	16	-42	12	02	0	44	35	-17	52	44	1	10	51	+35	43	32
Nov.	7	0	14	16	15	17	40	0	27	16	42	12	04	0	44	35	17	52	45	1	10	51	35	43	34
	17	0	14	15	15	17	40	0	27	16	42	12	06	0	44	35	17	52	47	1	10	51	35	43	35
	27	0	14	15	15	17	40	0	27	16	42	12	08	0	44	35	17	52	48	1	10	51	35	43	36
Dec.	7	0	14	15	15	17	40	0	27	15	42	12	10	0	44	35	17	52	49	1	10	51	35	43	37
	17	0	14	15	15	17	39	0	27	15	42	12	11	0	44	35	17	52	50	1	10	51	35	43	38
	27	0	14	15	+15	17	39	0	27	15	-42	12	11	0	44	35	-17	52	51	1	10	51	+35	43	38
	37	0	14	15	+15	17	38	0	27	15	-42	12	12	0	44	35	-17	52	52	1	10	51	+35	43	38

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		ζ Ceti						ν Ceti						α Arietis						α Ceti					
Mag. Spect.		3.73			K0 III			4.00			F7III			2.00			K2 III			2.53			M1.5IIIa		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	1	52	24	-10	14	43	2	00	54	-20	59	26	2	08	15	+23	33	04	3	03	16	+4	09	40
	11	1	52	23	10	14	43	2	00	54	20	59	27	2	08	15	23	33	04	3	03	16	4	09	39
	21	1	52	23	10	14	43	2	00	53	20	59	28	2	08	14	23	33	03	3	03	16	4	09	39
	31	1	52	23	10	14	44	2	00	53	20	59	28	2	08	14	23	33	03	3	03	16	4	09	38
Feb.	10	1	52	23	10	14	44	2	00	53	20	59	28	2	08	14	23	33	02	3	03	16	4	09	38
	20	1	52	23	10	14	44	2	00	53	20	59	27	2	08	14	23	33	01	3	03	16	4	09	37
Mar.	2	1	52	23	-10	14	44	2	00	53	-20	59	27	2	08	14	+23	33	00	3	03	16	+4	09	37
	12	1	52	23	10	14	43	2	00	53	20	59	26	2	08	14	23	32	59	3	03	15	4	09	37
	22	1	52	23	10	14	42	2	00	53	20	59	24	2	08	14	23	32	58	3	03	15	4	09	37
Apr.	1	1	52	23	10	14	41	2	00	53	20	59	23	2	08	14	23	32	58	3	03	15	4	09	37
	11	1	52	22	10	14	40	2	00	52	20	59	21	2	08	13	23	32	57	3	03	15	4	09	37
	21	1	52	23	10	14	39	2	00	53	20	59	19	2	08	14	23	32	56	3	03	15	4	09	38
May	1	1	52	23	-10	14	37	2	00	53	-20	59	17	2	08	14	+23	32	56	3	03	15	+4	09	39
	11	1	52	23	10	14	35	2	00	53	20	59	14	2	08	14	23	32	56	3	03	15	4	09	40
	21	1	52	23	10	14	33	2	00	53	20	59	12	2	08	14	23	32	56	3	03	15	4	09	41
	31	1	52	23	10	14	31	2	00	53	20	59	09	2	08	14	23	32	57	3	03	16	4	09	43
June	10	1	52	23	10	14	28	2	00	53	20	59	06	2	08	14	23	32	58	3	03	16	4	09	44
	20	1	52	24	10	14	26	2	00	54	20	59	04	2	08	15	23	32	59	3	03	16	4	09	46
	30	1	52	24	-10	14	24	2	00	54	-20	59	01	2	08	15	+23	33	00	3	03	16	+4	09	47
July	10	1	52	24	10	14	22	2	00	54	20	59	01	2	08	15	23	33	01	3	03	17	4	09	49
	20	1	52	25	10	14	20	2	00	55	20	58	57	2	08	16	23	33	03	3	03	17	4	09	51
	30	1	52	25	10	14	18	2	00	55	20	58	56	2	08	16	23	33	05	3	03	17	4	09	53
Aug.	9	1	52	25	10	14	17	2	00	55	20	58	54	2	08	16	23	33	07	3	03	17	4	09	54
	19	1	52	25	10	14	15	2	00	55	20	58	53	2	08	17	23	33	08	3	03	18	4	09	56
	29	1	52	26	-10	14	15	2	00	56	-20	58	53	2	08	17	+23	33	10	3	03	18	+4	09	57
Sept.	8	1	52	26	10	14	14	2	00	56	20	58	53	2	08	17	23	33	12	3	03	18	4	09	58
	18	1	52	26	10	14	14	2	00	56	20	58	53	2	08	17	23	33	14	3	03	19	4	09	59
	28	1	52	26	10	14	14	2	00	56	20	58	54	2	08	18	23	33	15	3	03	19	4	09	59
Oct.	8	1	52	26	10	14	15	2	00	57	20	58	55	2	08	18	23	33	17	3	03	19	4	10	00
	18	1	52	27	10	14	15	2	00	57	20	58	56	2	08	18	23	33	18	3	03	19	4	09	59
	28	1	52	27	-10	14	16	2	00	57	-20	58	58	2	08	18	+23	33	19	3	03	19	+4	09	59
Nov.	7	1	52	27	10	14	17	2	00	57	20	59	01	2	08	18	23	33	20	3	03	19	4	09	59
	17	1	52	27	10	14	19	2	00	57	20	59	01	2	08	18	23	33	20	3	03	19	4	09	58
	27	1	52	27	10	14	20	2	00	57	20	59	03	2	08	18	23	33	21	3	03	20	4	09	58
Dec.	7	1	52	27	10	14	21	2	00	57	20	59	05	2	08	18	23	33	21	3	03	20	4	09	57
	17	1	52	27	10	14	22	2	00	57	20	59	06	2	08	18	23	33	22	3	03	20	4	09	56
	27	1	52	26	-10	14	23	2	00	57	-20	59	07	2	08	18	+23	33	22	3	03	20	+4	09	56
	37	1	52	26	-10	14	24	2	00	56	-20	59	09	2	08	18	+23	33	22	3	03	19	+4	09	55

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		η Tauri						α Tauri						β Eridani						γ Orionis					
Mag. Spect.		2.87			B7 III			0.85			K5 III			2.79			K4 III			1.64			B2 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	3	48	37	+24	09	42	4	37	01	+16	32	41	5	08	48	-5	03	55	5	26	09	+6	21	49
	11	3	48	37	24	09	42	4	37	01	16	32	41	5	08	48	5	03	56	5	26	10	6	21	49
	21	3	48	37	24	09	42	4	37	01	16	32	40	5	08	47	5	03	57	5	26	09	6	21	48
	31	3	48	37	24	09	42	4	37	01	16	32	40	5	08	47	5	03	58	5	26	09	6	21	47
Feb.	10	3	48	37	24	09	42	4	37	01	16	32	40	5	08	47	5	03	59	5	26	09	6	21	47
	20	3	48	37	24	09	42	4	37	01	16	32	40	5	08	47	5	04	01	5	26	09	6	21	47
Mar.	2	3	48	36	+24	09	41	4	37	00	+16	32	40	5	08	47	-5	04	00	5	26	09	+6	21	46
	12	3	48	36	24	09	41	4	37	00	16	32	39	5	08	47	5	04	00	5	26	09	6	21	46
	22	3	48	36	24	09	41	4	36	60	16	32	39	5	08	47	5	04	00	5	26	09	6	21	46
Apr.	1	3	48	36	24	09	40	4	36	60	16	32	39	5	08	46	5	04	01	5	26	08	6	21	46
	11	3	48	36	24	09	39	4	36	60	16	32	39	5	08	46	5	03	59	5	26	08	6	21	47
	21	3	48	36	24	09	39	4	36	60	16	32	39	5	08	46	5	03	58	5	26	08	6	21	47
May	1	3	48	36	+24	09	39	4	36	60	+16	32	39	5	08	46	-5	03	57	5	26	08	+6	21	48
	11	3	48	36	24	09	38	4	36	60	16	32	39	5	08	46	5	03	56	5	26	08	6	21	48
	21	3	48	36	24	09	38	4	36	60	16	32	39	5	08	46	5	03	55	5	26	08	6	21	49
	31	3	48	36	24	09	38	4	36	60	16	32	40	5	08	46	5	03	53	5	26	08	6	21	50
June	10	3	48	36	24	09	39	4	36	60	16	32	41	5	08	46	5	03	51	5	26	08	6	21	51
	20	3	48	36	24	09	39	4	36	60	16	32	41	5	08	46	5	03	49	5	26	08	6	21	52
	30	3	48	37	+24	09	40	4	37	00	+16	32	42	5	08	46	-5	03	48	5	26	08	+6	21	53
July	10	3	48	37	24	09	41	4	37	00	16	32	43	5	08	47	5	03	46	5	26	09	6	21	55
	20	3	48	37	24	09	42	4	37	01	16	32	44	5	08	47	5	03	44	5	26	09	6	21	56
	30	3	48	38	24	09	43	4	37	01	16	32	45	5	08	47	5	03	42	5	26	09	6	21	57
Aug.	9	3	48	38	24	09	44	4	37	01	16	32	46	5	08	47	5	03	41	5	26	09	6	21	58
	19	3	48	38	24	09	45	4	37	02	16	32	47	5	08	48	5	03	39	5	26	10	6	21	59
	29	3	48	39	+24	09	46	4	37	02	+16	32	48	5	08	48	-5	03	38	5	26	10	+6	22	00
Sept.	8	3	48	39	24	09	47	4	37	02	16	32	49	5	08	48	5	03	37	5	26	10	6	22	01
	18	3	48	39	24	09	48	4	37	02	16	32	49	5	08	48	5	03	37	5	26	10	6	22	01
	28	3	48	39	24	09	50	4	37	03	16	32	50	5	08	49	5	03	37	5	26	11	6	22	01
Oct.	8	3	48	40	24	09	50	4	37	03	16	32	50	5	08	49	5	03	37	5	26	11	6	22	01
	18	3	48	40	24	09	51	4	37	03	16	32	51	5	08	49	5	03	38	5	26	11	6	22	01
	28	3	48	40	+24	09	52	4	37	04	+16	32	51	5	08	49	-5	03	38	5	26	12	+6	22	01
Nov.	7	3	48	40	24	09	53	4	37	04	16	32	51	5	08	50	5	03	40	5	26	12	6	22	00
	17	3	48	40	24	09	53	4	37	04	16	32	51	5	08	50	5	03	41	5	26	12	6	21	59
	27	3	48	41	24	09	54	4	37	04	16	32	51	5	08	50	5	03	42	5	26	12	6	21	58
Dec.	7	3	48	41	24	09	54	4	37	04	16	32	51	5	08	50	5	03	44	5	26	12	6	21	57
	17	3	48	41	24	09	55	4	37	04	16	32	50	5	08	50	5	03	45	5	26	13	6	21	56
	27	3	48	41	+24	09	55	4	37	04	+16	32	50	5	08	50	-5	03	47	5	26	13	+6	21	55
	37	3	48	41	+24	09	55	4	37	04	+16	32	50	5	08	50	-5	03	48	5	26	13	+6	21	55

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		β Leporis						ι Orionis						α Columbae						κ Orionis					
Mag. Spect.		2.84			G5 II			2.77			O9 III			2.64			B5 Ive			2.06			B0Iab		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	5	29	04	-20	44	52	5	36	22	-5	54	02	5	40	21	-34	04	02	5	48	40	-9	39	57
	11	5	29	04	20	44	54	5	36	22	5	54	04	5	40	21	34	04	05	5	48	40	9	39	59
	21	5	29	04	20	44	56	5	36	22	5	54	05	5	40	21	34	04	08	5	48	40	9	40	01
	31	5	29	04	20	44	57	5	36	22	5	54	06	5	40	21	34	04	10	5	48	40	9	40	02
Feb.	10	5	29	04	20	44	59	5	36	22	5	54	07	5	40	21	34	04	11	5	48	40	9	40	03
	20	5	29	04	20	45	01	5	36	22	5	54	07	5	40	21	34	04	12	5	48	40	9	40	04
Mar.	2	5	29	04	-20	45	00	5	36	22	-5	54	08	5	40	20	-34	04	13	5	48	40	-9	40	04
	12	5	29	03	20	45	00	5	36	22	5	54	08	5	40	20	34	04	14	5	48	39	9	40	04
	22	5	29	03	20	45	00	5	36	21	5	54	08	5	40	20	34	04	13	5	48	39	9	40	04
Apr.	1	5	29	03	20	45	00	5	36	21	5	54	08	5	40	20	34	04	13	5	48	39	9	40	04
	11	5	29	03	20	44	59	5	36	21	5	54	07	5	40	19	34	04	12	5	48	39	9	40	04
	21	5	29	03	20	44	58	5	36	21	5	54	06	5	40	19	34	04	11	5	48	39	9	40	03
May	1	5	29	03	-20	44	56	5	36	21	-5	54	05	5	40	19	-34	04	09	5	48	39	-9	40	02
	11	5	29	02	20	44	54	5	36	21	5	54	04	5	40	19	34	04	07	5	48	39	9	40	00
	21	5	29	02	20	44	53	5	36	21	5	54	03	5	40	19	34	04	04	5	48	38	9	39	59
	31	5	29	02	20	44	50	5	36	21	5	54	01	5	40	19	34	04	02	5	48	38	9	39	57
June	10	5	29	02	20	44	48	5	36	21	5	54	00	5	40	19	34	03	59	5	48	38	9	39	55
	20	5	29	03	20	44	45	5	36	21	5	53	58	5	40	19	34	03	56	5	48	39	9	39	54
	30	5	29	03	-20	44	43	5	36	21	-5	53	56	5	40	19	-34	03	53	5	48	39	-9	39	52
July	10	5	29	03	20	44	40	5	36	21	5	53	54	5	40	19	34	03	50	5	48	39	9	39	49
	20	5	29	03	20	44	38	5	36	21	5	53	52	5	40	19	34	03	47	5	48	39	9	39	48
	30	5	29	03	20	44	36	5	36	22	5	53	51	5	40	20	34	03	44	5	48	39	9	39	46
Aug.	9	5	29	04	20	44	34	5	36	22	5	53	49	5	40	20	34	03	42	5	48	39	9	39	44
	19	5	29	04	20	44	32	5	36	22	5	53	48	5	40	20	34	03	40	5	48	40	9	39	43
	29	5	29	04	-20	44	31	5	36	22	-5	53	47	5	40	21	-34	03	38	5	48	40	-9	39	41
Sept.	8	5	29	04	20	44	30	5	36	23	5	53	46	5	40	21	34	03	37	5	48	40	9	39	41
	18	5	29	05	20	44	29	5	36	23	5	53	46	5	40	21	34	03	37	5	48	41	9	39	40
	28	5	29	05	20	44	29	5	36	23	5	53	45	5	40	21	34	03	37	5	48	41	9	39	40
Oct.	8	5	29	05	20	44	30	5	36	24	5	53	46	5	40	22	34	03	38	5	48	41	9	39	40
	18	5	29	06	20	44	31	5	36	24	5	53	46	5	40	22	34	03	39	5	48	41	9	39	41
	28	5	29	06	-20	44	32	5	36	24	-5	53	47	5	40	22	-34	03	40	5	48	42	-9	39	42
Nov.	7	5	29	06	20	44	34	5	36	24	5	53	48	5	40	23	34	03	42	5	48	42	9	39	43
	17	5	29	06	20	44	36	5	36	25	5	53	50	5	40	23	34	03	45	5	48	42	9	39	45
	27	5	29	06	20	44	38	5	36	25	5	53	51	5	40	23	34	03	48	5	48	42	9	39	47
Dec.	7	5	29	07	20	44	40	5	36	25	5	53	53	5	40	23	34	03	50	5	48	43	9	39	49
	17	5	29	07	20	44	43	5	36	25	5	53	55	5	40	23	34	03	53	5	48	43	9	39	51
	27	5	29	07	-20	44	45	5	36	25	-5	53	56	5	40	23	-34	03	56	5	48	43	-9	39	53
	37	5	29	07	-20	44	47	5	36	25	-5	53	58	5	40	23	-34	04	01	5	48	43	-9	39	54

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		α Orionis						ζ Canis Majoris						α Carinae						γ Geminorum					
Mag. Spect.		0.4 - 1.3			M2Iab			3.02			B2.5V			-0.72			F0II			1.93			A0 IV		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	5	56	13	+7	24	27	6	21	32	+30	03	09	6	24	24	-52	42	29	6	38	49	+16	22	48
	11	5	56	13	7	24	26	6	21	32	30	03	09	6	24	24	52	42	32	6	38	49	16	22	47
	21	5	56	13	7	24	26	6	21	32	30	03	10	6	24	24	52	42	36	6	38	49	16	22	47
	31	5	56	13	7	24	25	6	21	32	30	03	11	6	24	24	52	42	38	6	38	49	16	22	47
Feb.	10	5	56	12	7	24	25	6	21	32	30	03	11	6	24	24	52	42	41	6	38	49	16	22	47
	20	5	56	12	7	24	24	6	21	32	30	03	12	6	24	24	52	42	43	6	38	49	16	22	47
Mar.	2	5	56	12	+7	24	24	6	21	32	+30	03	12	6	24	23	-52	42	44	6	38	49	+16	22	47
	12	5	56	12	7	24	24	6	21	32	30	03	13	6	24	23	52	42	45	6	38	49	16	22	47
	22	5	56	12	7	24	24	6	21	32	30	03	13	6	24	23	52	42	46	6	38	48	16	22	48
Apr.	1	5	56	12	7	24	24	6	21	31	30	03	13	6	24	22	52	42	46	6	38	48	16	22	48
	11	5	56	11	7	24	24	6	21	31	30	03	13	6	24	22	52	42	45	6	38	48	16	22	48
	21	5	56	11	7	24	25	6	21	31	30	03	13	6	24	22	52	42	44	6	38	48	16	22	48
May	1	5	56	11	+7	24	25	6	21	31	+30	03	13	6	24	21	-52	42	42	6	38	48	+16	22	48
	11	5	56	11	7	24	26	6	21	31	30	03	12	6	24	21	52	42	40	6	38	48	16	22	49
	21	5	56	11	7	24	26	6	21	31	30	03	12	6	24	21	52	42	38	6	38	48	16	22	49
	31	5	56	11	7	24	27	6	21	31	30	03	12	6	24	21	52	42	35	6	38	48	16	22	49
June	10	5	56	11	7	24	28	6	21	31	30	03	11	6	24	21	52	42	32	6	38	48	16	22	50
	20	5	56	11	7	24	29	6	21	31	30	03	11	6	24	21	52	42	29	6	38	48	16	22	50
	30	5	56	11	+7	24	30	6	21	31	+30	03	10	6	24	21	-52	42	26	6	38	48	+16	22	50
July	10	5	56	11	7	24	31	6	21	31	30	03	10	6	24	21	52	42	22	6	38	48	16	22	51
	20	5	56	12	7	24	33	6	21	31	30	03	10	6	24	21	52	42	19	6	38	48	16	22	51
	30	5	56	12	7	24	33	6	21	32	30	03	10	6	24	21	52	42	16	6	38	48	16	22	51
Aug.	9	5	56	12	7	24	35	6	21	32	30	03	10	6	24	21	52	42	13	6	38	48	16	22	52
	19	5	56	12	7	24	36	6	21	32	30	03	09	6	24	22	52	42	10	6	38	49	16	22	52
	29	5	56	13	+7	24	36	6	21	32	+30	03	09	6	24	22	-52	42	08	6	38	49	+16	22	52
Sept.	8	5	56	13	7	24	37	6	21	33	30	03	09	6	24	22	52	42	07	6	38	49	16	22	53
	18	5	56	13	7	24	37	6	21	33	30	03	09	6	24	23	52	42	06	6	38	50	16	22	53
	28	5	56	14	7	24	37	6	21	33	30	03	09	6	24	23	52	42	05	6	38	50	16	22	53
Oct.	8	5	56	14	7	24	37	6	21	34	30	03	09	6	24	23	52	42	06	6	38	50	16	22	52
	18	5	56	14	7	24	37	6	21	34	30	03	09	6	24	24	52	42	07	6	38	50	16	22	52
	28	5	56	14	+7	24	36	6	21	34	+30	03	09	6	24	24	-52	42	08	6	38	51	+16	22	51
Nov.	7	5	56	15	7	24	35	6	21	35	30	03	09	6	24	25	52	42	10	6	38	51	16	22	51
	17	5	56	15	7	24	34	6	21	35	30	03	09	6	24	25	52	42	13	6	38	51	16	22	50
	27	5	56	15	7	24	34	6	21	35	30	03	09	6	24	25	52	42	16	6	38	52	16	22	49
Dec.	7	5	56	15	7	24	33	6	21	36	30	03	09	6	24	25	52	42	19	6	38	52	16	22	49
	17	5	56	16	7	24	32	6	21	36	30	03	09	6	24	26	52	42	23	6	38	52	16	22	48
	27	5	56	16	+7	24	31	6	21	36	+30	03	10	6	24	26	-52	42	26	6	38	52	+16	22	47
	37	5	56	16	+7	24	30	6	21	36	+30	03	10	6	24	26	-52	42	30	6	38	52	+16	22	47

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		α Canis Majoris A						o^2 Canis Majoris						β Canis Minoris						α Canis Minoris A					
Mag. Spect.		-1.46			A1V			3.02			B3 Ia			2.90			B8Ve			0.38			F5 IV-V		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	6	46	00	-16	44	40	7	03	50	-23	51	46	7	28	11	+8	14	54	7	40	18	+5	10	26
	11	6	46	00	16	44	43	7	03	50	23	51	49	7	28	11	8	14	53	7	40	18	5	10	25
	21	6	46	00	16	44	45	7	03	50	23	51	51	7	28	11	8	14	53	7	40	18	5	10	24
	31	6	46	00	16	44	47	7	03	50	23	51	54	7	28	12	8	14	52	7	40	18	5	10	23
Feb.	10	6	46	00	16	44	48	7	03	50	23	51	55	7	28	11	8	14	52	7	40	18	5	10	22
	20	6	46	00	16	44	50	7	03	50	23	51	57	7	28	11	8	14	51	7	40	18	5	10	22
Mar.	2	6	46	00	-16	44	51	7	03	50	-23	51	59	7	28	11	+8	14	51	7	40	18	+5	10	21
	12	6	45	59	16	44	51	7	03	49	23	52	01	7	28	11	8	14	51	7	40	18	5	10	21
	22	6	45	59	16	44	51	7	03	49	23	52	00	7	28	11	8	14	51	7	40	18	5	10	21
Apr.	1	6	45	59	16	44	52	7	03	49	23	52	00	7	28	11	8	14	51	7	40	18	5	10	21
	11	6	45	59	16	44	51	7	03	49	23	52	00	7	28	11	8	14	51	7	40	18	5	10	21
	21	6	45	59	16	44	51	7	03	49	23	52	01	7	28	11	8	14	52	7	40	17	5	10	22
May	1	6	45	58	-16	44	50	7	03	49	-23	51	59	7	28	10	+8	14	52	7	40	17	+5	10	22
	11	6	45	58	16	44	48	7	03	48	23	51	57	7	28	10	8	14	53	7	40	17	5	10	23
	21	6	45	58	16	44	47	7	03	48	23	51	56	7	28	10	8	14	53	7	40	17	5	10	23
	31	6	45	58	16	44	45	7	03	48	23	51	54	7	28	10	8	14	54	7	40	17	5	10	24
June	10	6	45	58	16	44	43	7	03	48	23	51	52	7	28	10	8	14	55	7	40	17	5	10	25
	20	6	45	58	16	44	41	7	03	48	23	51	50	7	28	10	8	14	55	7	40	17	5	10	26
	30	6	45	58	-16	44	39	7	03	48	-23	51	47	7	28	10	+8	14	56	7	40	17	+5	10	26
July	10	6	45	58	16	44	37	7	03	48	23	51	45	7	28	10	8	14	57	7	40	17	5	10	27
	20	6	45	58	16	44	35	7	03	48	23	51	42	7	28	10	8	14	58	7	40	17	5	10	28
	30	6	45	59	16	44	33	7	03	48	23	51	40	7	28	10	8	14	58	7	40	17	5	10	29
Aug.	9	6	45	59	16	44	31	7	03	49	23	51	38	7	28	11	8	14	59	7	40	17	5	10	30
	19	6	45	59	16	44	29	7	03	49	23	51	36	7	28	11	8	15	00	7	40	18	5	10	30
	29	6	45	59	-16	44	28	7	03	49	-23	51	34	7	28	11	+8	15	00	7	40	18	+5	10	31
Sept.	8	6	46	00	16	44	27	7	03	49	23	51	33	7	28	11	8	15	00	7	40	18	5	10	31
	18	6	46	00	16	44	26	7	03	50	23	51	32	7	28	12	8	15	00	7	40	18	5	10	31
	28	6	46	00	16	44	26	7	03	50	23	51	31	7	28	12	8	15	00	7	40	19	5	10	31
Oct.	8	6	46	00	16	44	27	7	03	50	23	51	32	7	28	12	8	14	59	7	40	19	5	10	30
	18	6	46	01	16	44	27	7	03	51	23	51	32	7	28	12	8	14	59	7	40	19	5	10	29
	28	6	46	01	-16	44	28	7	03	51	-23	51	33	7	28	13	+8	14	58	7	40	19	+5	10	29
Nov.	7	6	46	01	16	44	30	7	03	51	23	51	35	7	28	13	8	14	57	7	40	20	5	10	27
	17	6	46	02	16	44	32	7	03	51	23	51	37	7	28	13	8	14	55	7	40	20	5	10	26
	27	6	46	02	16	44	34	7	03	52	23	51	39	7	28	14	8	14	54	7	40	20	5	10	25
Dec.	7	6	46	02	16	44	36	7	03	52	23	51	42	7	28	14	8	14	53	7	40	21	5	10	23
	17	6	46	02	16	44	39	7	03	52	23	51	44	7	28	14	8	14	52	7	40	21	5	10	22
	27	6	46	02	-16	44	41	7	03	52	-23	51	47	7	28	14	+8	14	50	7	40	21	+5	10	20
	37	6	46	02	-16	44	44	7	03	52	-23	51	50	7	28	14	+8	14	49	7	40	21	+5	10	19

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		β Geminorum						ξ Puppis						ρ Puppis						ζ Hydrae					
Mag. Spect.		1.14			K0IIIb			3.34			G6 Ia			2.81			F6IIp			3.11			G9 II-III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	7	46	29	+27	58	38	7	50	06	-24	54	30	8	08	22	-24	21	34	8	56	24	+5	52	18
	11	7	46	29	27	58	38	7	50	07	24	54	33	8	08	22	24	21	37	8	56	24	5	52	17
	21	7	46	29	27	58	38	7	50	07	24	54	35	8	08	22	24	21	40	8	56	24	5	52	15
	31	7	46	29	27	58	39	7	50	07	24	54	38	8	08	22	24	21	43	8	56	25	5	52	14
Feb.	10	7	46	29	27	58	40	7	50	07	24	54	40	8	08	22	24	21	45	8	56	25	5	52	14
	20	7	46	29	27	58	40	7	50	07	24	54	42	8	08	22	24	21	47	8	56	25	5	52	13
Mar.	2	7	46	29	+27	58	41	7	50	06	-24	54	44	8	08	22	-24	21	49	8	56	25	+5	52	12
	12	7	46	29	27	58	42	7	50	06	24	54	45	8	08	22	24	21	50	8	56	25	5	52	12
	22	7	46	29	27	58	43	7	50	06	24	54	46	8	08	22	24	21	51	8	56	24	5	52	13
Apr.	1	7	46	29	27	58	43	7	50	06	24	54	47	8	08	22	24	21	52	8	56	24	5	52	13
	11	7	46	28	27	58	44	7	50	06	24	54	47	8	08	21	24	21	52	8	56	24	5	52	13
	21	7	46	28	27	58	44	7	50	05	24	54	46	8	08	21	24	21	52	8	56	24	5	52	13
May	1	7	46	28	+27	58	44	7	50	05	-24	54	46	8	08	21	-24	21	51	8	56	24	+5	52	14
	11	7	46	28	27	58	44	7	50	05	24	54	45	8	08	21	24	21	51	8	56	24	5	52	14
	21	7	46	28	27	58	44	7	50	05	24	54	44	8	08	21	24	21	50	8	56	24	5	52	15
	31	7	46	28	27	58	44	7	50	05	24	54	42	8	08	21	24	21	48	8	56	23	5	52	16
June	10	7	46	28	27	58	44	7	50	05	24	54	40	8	08	21	24	21	46	8	56	23	5	52	16
	20	7	46	28	27	58	44	7	50	05	24	54	38	8	08	20	24	21	45	8	56	23	5	52	17
	30	7	46	28	+27	58	43	7	50	05	-24	54	36	8	08	20	-24	21	43	8	56	23	+5	52	18
July	10	7	46	28	27	58	43	7	50	05	24	54	34	8	08	20	24	21	40	8	56	23	5	52	18
	20	7	46	28	27	58	42	7	50	05	24	54	31	8	08	20	24	21	38	8	56	23	5	52	19
	30	7	46	28	27	58	42	7	50	05	24	54	29	8	08	21	24	21	36	8	56	23	5	52	19
Aug.	9	7	46	28	27	58	41	7	50	05	24	54	27	8	08	21	24	21	34	8	56	23	5	52	20
	19	7	46	28	27	58	41	7	50	05	24	54	25	8	08	21	24	21	31	8	56	24	5	52	20
	29	7	46	29	+27	58	40	7	50	05	-24	54	23	8	08	21	-24	21	30	8	56	24	+5	52	20
Sept.	8	7	46	29	27	58	39	7	50	06	24	54	22	8	08	21	24	21	28	8	56	24	5	52	20
	18	7	46	29	27	58	39	7	50	06	24	54	20	8	08	21	24	21	27	8	56	24	5	52	20
	28	7	46	30	27	58	38	7	50	06	24	54	20	8	08	22	24	21	26	8	56	24	5	52	20
Oct.	8	7	46	30	27	58	37	7	50	06	24	54	20	8	08	22	24	21	26	8	56	25	5	52	19
	18	7	46	30	27	58	36	7	50	07	24	54	20	8	08	22	24	21	27	8	56	25	5	52	18
	28	7	46	31	+27	58	35	7	50	07	-24	54	21	8	08	23	-24	21	27	8	56	25	+5	52	17
Nov.	7	7	46	31	27	58	34	7	50	07	24	54	22	8	08	23	24	21	29	8	56	25	5	52	16
	17	7	46	31	27	58	33	7	50	08	24	54	24	8	08	23	24	21	31	8	56	26	5	52	14
	27	7	46	32	27	58	33	7	50	08	24	54	27	8	08	24	24	21	33	8	56	26	5	52	13
Dec.	7	7	46	32	27	58	32	7	50	08	24	54	29	8	08	24	24	21	35	8	56	26	5	52	11
	17	7	46	32	27	58	32	7	50	09	24	54	32	8	08	24	24	21	38	8	56	27	5	52	09
	27	7	46	32	+27	58	32	7	50	09	-24	54	35	8	08	24	-24	21	41	8	56	27	+5	52	07
	37	7	46	33	+27	58	32	7	50	09	-24	54	37	8	08	24	-24	21	43	8	56	27	+5	52	06

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		λ Velorum						α Hydrae						α Leonis						α Antliae					
Mag. Spect.		2.21			K4 Ib-II			1.98			K3 II-III			1.35			B7 V			4.25			K4 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	9	08	43	-43	30	26	9	28	31	-8	44	27	10	09	23	+11	52	23	10	28	02	-31	09	42
	11	9	08	43	43	30	30	9	28	32	8	44	29	10	09	23	11	52	22	10	28	02	31	09	45
	21	9	08	43	43	30	33	9	28	32	8	44	31	10	09	23	11	52	21	10	28	02	31	09	48
	31	9	08	43	43	30	36	9	28	32	8	44	33	10	09	24	11	52	20	10	28	02	31	09	51
Feb.	10	9	08	43	43	30	40	9	28	32	8	44	35	10	09	24	11	52	19	10	28	03	31	09	53
	20	9	08	43	43	30	43	9	28	32	8	44	37	10	09	24	11	52	19	10	28	03	31	09	56
Mar.	2	9	08	43	-43	30	46	9	28	32	-8	44	38	10	09	24	+11	52	19	10	28	03	-31	09	59
	12	9	08	43	43	30	48	9	28	32	8	44	39	10	09	24	11	52	19	10	28	03	31	10	01
	22	9	08	43	43	30	50	9	28	32	8	44	40	10	09	24	11	52	19	10	28	03	31	10	03
Apr.	1	9	08	43	43	30	52	9	28	32	8	44	40	10	09	24	11	52	20	10	28	03	31	10	05
	11	9	08	43	43	30	53	9	28	32	8	44	40	10	09	24	11	52	20	10	28	02	31	10	07
	21	9	08	42	43	30	54	9	28	32	8	44	40	10	09	23	11	52	21	10	28	02	31	10	08
May	1	9	08	42	-43	30	55	9	28	32	-8	44	40	10	09	23	+11	52	22	10	28	02	-31	10	08
	11	9	08	42	43	30	55	9	28	31	8	44	40	10	09	23	11	52	22	10	28	02	31	10	09
	21	9	08	42	43	30	54	9	28	31	8	44	39	10	09	23	11	52	23	10	28	02	31	10	09
	31	9	08	41	43	30	53	9	28	31	8	44	38	10	09	23	11	52	24	10	28	02	31	10	08
June	10	9	08	41	43	30	52	9	28	31	8	44	38	10	09	23	11	52	24	10	28	02	31	10	08
	20	9	08	41	43	30	50	9	28	31	8	44	37	10	09	23	11	52	25	10	28	01	31	10	07
	30	9	08	41	-43	30	48	9	28	31	-8	44	35	10	09	23	+11	52	25	10	28	01	-31	10	06
July	10	9	08	41	43	30	45	9	28	31	8	44	34	10	09	23	11	52	25	10	28	01	31	10	04
	20	9	08	41	43	30	43	9	28	31	8	44	33	10	09	23	11	52	26	10	28	01	31	10	02
	30	9	08	41	43	30	40	9	28	31	8	44	32	10	09	23	11	52	26	10	28	01	31	10	00
Aug.	9	9	08	41	43	30	37	9	28	31	8	44	30	10	09	23	11	52	26	10	28	01	31	09	58
	19	9	08	41	43	30	35	9	28	31	8	44	29	10	09	23	11	52	26	10	28	01	31	09	56
	29	9	08	41	-43	30	32	9	28	31	-8	44	28	10	09	23	+11	52	25	10	28	01	-31	09	54
Sept.	8	9	08	41	43	30	30	9	28	31	8	44	27	10	09	23	11	52	25	10	28	01	31	09	52
	18	9	08	41	43	30	28	9	28	31	8	44	27	10	09	23	11	52	24	10	28	01	31	09	51
	28	9	08	42	43	30	26	9	28	32	8	44	27	10	09	23	11	52	23	10	28	01	31	09	49
Oct.	8	9	08	42	43	30	25	9	28	32	8	44	27	10	09	23	11	52	22	10	28	02	31	09	48
	18	9	08	42	43	30	25	9	28	32	8	44	27	10	09	24	11	52	21	10	28	02	31	09	48
	28	9	08	43	-43	30	25	9	28	32	-8	44	28	10	09	24	+11	52	19	10	28	02	-31	09	48
Nov.	7	9	08	43	43	30	25	9	28	33	8	44	29	10	09	24	11	52	18	10	28	02	31	09	48
	17	9	08	43	43	30	27	9	28	33	8	44	31	10	09	24	11	52	16	10	28	03	31	09	49
	27	9	08	44	43	30	28	9	28	33	8	44	33	10	09	25	11	52	14	10	28	03	31	09	50
Dec.	7	9	08	44	43	30	31	9	28	34	8	44	35	10	09	25	11	52	12	10	28	03	31	09	52
	17	9	08	44	43	30	34	9	28	34	8	44	37	10	09	25	11	52	10	10	28	04	31	09	54
	27	9	08	45	-43	30	37	9	28	34	-8	44	39	10	09	26	+11	52	08	10	28	04	-31	09	57
	37	9	08	45	-43	30	40	9	28	34	-8	44	41	10	09	26	+11	52	07	10	28	04	-31	10	01

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		ν Hydrae						ξ Hydrae						β Leonis						γ Corvi					
Mag. Spect.		3.11			K0/K1III			3.54			G7 III			2.14			A3 V			2.59			B8III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	10	50	34	-16	17	27	11	33	56	-31	57	31	11	50	01	+14	27	56	12	16	47	-17	38	38
	11	10	50	34	16	17	30	11	33	57	31	57	33	11	50	01	14	27	54	12	16	47	17	38	41
	21	10	50	34	16	17	33	11	33	57	31	57	36	11	50	02	14	27	53	12	16	47	17	38	43
	31	10	50	34	16	17	35	11	33	57	31	57	39	11	50	02	14	27	52	12	16	47	17	38	45
Feb.	10	10	50	35	16	17	37	11	33	57	31	57	42	11	50	02	14	27	51	12	16	48	17	38	47
	20	10	50	35	16	17	39	11	33	58	31	57	45	11	50	02	14	27	50	12	16	48	17	38	50
Mar.	2	10	50	35	-16	17	41	11	33	58	-31	57	47	11	50	02	+14	27	50	12	16	48	-17	38	51
	12	10	50	35	16	17	43	11	33	58	31	57	50	11	50	03	14	27	51	12	16	48	17	38	53
	22	10	50	35	16	17	44	11	33	58	31	57	52	11	50	03	14	27	51	12	16	48	17	38	55
Apr.	1	10	50	35	16	17	45	11	33	58	31	57	54	11	50	03	14	27	52	12	16	48	17	38	56
	11	10	50	35	16	17	46	11	33	58	31	57	56	11	50	03	14	27	53	12	16	48	17	38	57
	21	10	50	35	16	17	46	11	33	58	31	57	57	11	50	03	14	27	54	12	16	48	17	38	58
May	1	10	50	35	-16	17	47	11	33	58	-31	57	59	11	50	03	+14	27	54	12	16	48	-17	38	58
	11	10	50	34	16	17	47	11	33	57	31	58	01	11	50	02	14	27	55	12	16	48	17	38	59
	21	10	50	34	16	17	47	11	33	57	31	58	00	11	50	02	14	27	56	12	16	48	17	38	59
	31	10	50	34	16	17	46	11	33	57	31	58	00	11	50	02	14	27	57	12	16	48	17	38	59
June	10	10	50	34	16	17	46	11	33	57	31	58	00	11	50	02	14	27	58	12	16	48	17	38	59
	20	10	50	34	16	17	45	11	33	57	31	58	01	11	50	02	14	27	59	12	16	48	17	38	58
	30	10	50	34	-16	17	44	11	33	57	-31	57	59	11	50	02	+14	27	59	12	16	48	-17	38	58
July	10	10	50	34	16	17	43	11	33	57	31	57	58	11	50	02	14	28	00	12	16	48	17	38	57
	20	10	50	34	16	17	42	11	33	56	31	57	56	11	50	02	14	28	00	12	16	48	17	38	56
	30	10	50	34	16	17	40	11	33	56	31	57	55	11	50	02	14	28	00	12	16	47	17	38	55
Aug.	9	10	50	34	16	17	39	11	33	56	31	57	53	11	50	02	14	28	00	12	16	47	17	38	54
	19	10	50	34	16	17	37	11	33	56	31	57	51	11	50	02	14	27	59	12	16	47	17	38	53
	29	10	50	34	-16	17	36	11	33	56	-31	57	50	11	50	02	+14	27	59	12	16	47	-17	38	52
Sept.	8	10	50	34	16	17	35	11	33	56	31	57	48	11	50	02	14	27	58	12	16	47	17	38	51
	18	10	50	34	16	17	34	11	33	56	31	57	46	11	50	02	14	27	57	12	16	47	17	38	50
	28	10	50	34	16	17	34	11	33	56	31	57	45	11	50	02	14	27	56	12	16	47	17	38	49
Oct.	8	10	50	34	16	17	33	11	33	56	31	57	43	11	50	02	14	27	54	12	16	47	17	38	49
	18	10	50	34	16	17	33	11	33	57	31	57	42	11	50	02	14	27	53	12	16	47	17	38	49
	28	10	50	34	-16	17	34	11	33	57	-31	57	42	11	50	02	+14	27	51	12	16	47	-17	38	49
Nov.	7	10	50	35	16	17	35	11	33	57	31	57	42	11	50	02	14	27	49	12	16	48	17	38	49
	17	10	50	35	16	17	36	11	33	57	31	57	42	11	50	03	14	27	47	12	16	48	17	38	50
	27	10	50	35	16	17	37	11	33	58	31	57	43	11	50	03	14	27	44	12	16	48	17	38	51
Dec.	7	10	50	36	16	17	39	11	33	58	31	57	45	11	50	03	14	27	42	12	16	49	17	38	53
	17	10	50	36	16	17	41	11	33	58	31	57	46	11	50	03	14	27	40	12	16	49	17	38	55
	27	10	50	36	-16	17	44	11	33	59	-31	57	49	11	50	04	+14	27	38	12	16	49	-17	38	57
	37	10	50	37	-16	17	46	11	33	59	-31	57	51	11	50	04	+14	27	36	12	16	50	-17	38	59

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		β Corvi						δ Virginis						ε Virginis						ι Centauri					
Mag. Spect.		2.65			G5 II			3.38			M3III			2.83			G8 III			2.75			kA15hA3nA3va		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	12	35	23	-23	29	51	12	56	33	+3	17	45	13	03	06	+10	51	28	13	21	39	-36	48	24
	11	12	35	23	23	29	54	12	56	33	3	17	43	13	03	07	10	51	26	13	21	40	36	48	26
	21	12	35	23	23	29	56	12	56	33	3	17	41	13	03	07	10	51	24	13	21	40	36	48	28
	31	12	35	24	23	29	58	12	56	34	3	17	39	13	03	07	10	51	23	13	21	40	36	48	30
Feb.	10	12	35	24	23	30	00	12	56	34	3	17	38	13	03	08	10	51	22	13	21	41	36	48	32
	20	12	35	24	23	30	03	12	56	34	3	17	36	13	03	08	10	51	21	13	21	41	36	48	35
Mar.	2	12	35	24	-23	30	05	12	56	34	+3	17	35	13	03	08	+10	51	20	13	21	41	-36	48	37
	12	12	35	24	23	30	07	12	56	34	3	17	35	13	03	08	10	51	20	13	21	41	36	48	39
	22	12	35	25	23	30	09	12	56	35	3	17	35	13	03	08	10	51	20	13	21	42	36	48	42
Apr.	1	12	35	25	23	30	11	12	56	35	3	17	35	13	03	08	10	51	21	13	21	42	36	48	44
	11	12	35	25	23	30	12	12	56	35	3	17	35	13	03	08	10	51	22	13	21	42	36	48	46
	21	12	35	25	23	30	13	12	56	35	3	17	35	13	03	08	10	51	22	13	21	42	36	48	48
May	1	12	35	25	-23	30	14	12	56	35	+3	17	36	13	03	08	+10	51	23	13	21	42	-36	48	50
	11	12	35	25	23	30	15	12	56	35	3	17	36	13	03	08	10	51	24	13	21	42	36	48	52
	21	12	35	24	23	30	15	12	56	35	3	17	37	13	03	08	10	51	26	13	21	42	36	48	53
	31	12	35	24	23	30	15	12	56	35	3	17	38	13	03	08	10	51	27	13	21	42	36	48	54
June	10	12	35	24	23	30	15	12	56	35	3	17	39	13	03	08	10	51	27	13	21	42	36	48	55
	20	12	35	24	23	30	15	12	56	34	3	17	39	13	03	08	10	51	28	13	21	42	36	48	55
	30	12	35	24	-23	30	15	12	56	34	+3	17	40	13	03	08	+10	51	29	13	21	41	-36	48	55
July	10	12	35	24	23	30	14	12	56	34	3	17	41	13	03	08	10	51	30	13	21	41	36	48	55
	20	12	35	24	23	30	13	12	56	34	3	17	41	13	03	08	10	51	30	13	21	41	36	48	55
	30	12	35	24	23	30	12	12	56	34	3	17	42	13	03	08	10	51	31	13	21	41	36	48	54
Aug.	9	12	35	24	23	30	11	12	56	34	3	17	42	13	03	08	10	51	31	13	21	41	36	48	53
	19	12	35	23	23	30	10	12	56	34	3	17	42	13	03	08	10	51	31	13	21	41	36	48	52
	29	12	35	23	-23	30	09	12	56	34	+3	17	42	13	03	07	+10	51	30	13	21	40	-36	48	50
Sept.	8	12	35	23	23	30	08	12	56	34	3	17	42	13	03	07	10	51	30	13	21	40	36	48	49
	18	12	35	23	23	30	06	12	56	34	3	17	42	13	03	07	10	51	29	13	21	40	36	48	47
	28	12	35	23	23	30	05	12	56	34	3	17	41	13	03	07	10	51	28	13	21	40	36	48	45
Oct.	8	12	35	23	23	30	05	12	56	34	3	17	40	13	03	07	10	51	27	13	21	40	36	48	44
	18	12	35	23	23	30	04	12	56	34	3	17	40	13	03	07	10	51	25	13	21	40	36	48	42
	28	12	35	24	-23	30	04	12	56	34	+3	17	38	13	03	07	+10	51	24	13	21	40	-36	48	41
Nov.	7	12	35	24	23	30	04	12	56	34	3	17	37	13	03	08	10	51	22	13	21	41	36	48	41
	17	12	35	24	23	30	04	12	56	34	3	17	35	13	03	08	10	51	19	13	21	41	36	48	40
	27	12	35	24	23	30	05	12	56	35	3	17	33	13	03	08	10	51	17	13	21	41	36	48	40
Dec.	7	12	35	25	23	30	06	12	56	35	3	17	31	13	03	08	10	51	15	13	21	41	36	48	40
	17	12	35	25	23	30	08	12	56	35	3	17	28	13	03	09	10	51	12	13	21	42	36	48	41
	27	12	35	25	-23	30	10	12	56	35	+3	17	26	13	03	09	+10	51	10	13	21	42	-36	48	42
	37	12	35	26	-23	30	12	12	56	36	+3	17	24	13	03	09	+10	51	08	13	21	43	-36	48	44

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		α Virginis						θ Centauri						α^2 Librae						β Lupi					
Mag. Spect.		0.98			B1 III-V+			2.06			K0 III			2.75			KA2HA5MA4IV-V			2.68			B2 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	13	26	11	-11	15	25	14	07	47	-36	27	26	14	51	54	-16	06	59	14	59	45	-43	12	14
	11	13	26	11	11	15	27	14	07	47	36	27	28	14	51	55	16	07	01	14	59	45	43	12	15
	21	13	26	11	11	15	29	14	07	48	36	27	29	14	51	55	16	07	02	14	59	46	43	12	16
	31	13	26	12	11	15	31	14	07	48	36	27	31	14	51	55	16	07	04	14	59	46	43	12	17
Feb.	10	13	26	12	11	15	33	14	07	48	36	27	33	14	51	56	16	07	05	14	59	47	43	12	18
	20	13	26	12	11	15	35	14	07	49	36	27	35	14	51	56	16	07	07	14	59	47	43	12	20
Mar.	2	13	26	12	-11	15	36	14	07	49	-36	27	38	14	51	56	-16	07	08	14	59	47	-43	12	22
	12	13	26	13	11	15	37	14	07	49	36	27	40	14	51	56	16	07	10	14	59	48	43	12	24
	22	13	26	13	11	15	39	14	07	50	36	27	42	14	51	57	16	07	11	14	59	48	43	12	26
Apr.	1	13	26	13	11	15	40	14	07	50	36	27	44	14	51	57	16	07	12	14	59	48	43	12	28
	11	13	26	13	11	15	40	14	07	50	36	27	46	14	51	57	16	07	12	14	59	49	43	12	30
	21	13	26	13	11	15	41	14	07	50	36	27	48	14	51	57	16	07	13	14	59	49	43	12	32
May	1	13	26	13	-11	15	41	14	07	50	-36	27	50	14	51	57	-16	07	14	14	59	49	-43	12	34
	11	13	26	13	11	15	41	14	07	50	36	27	51	14	51	57	16	07	14	14	59	49	43	12	36
	21	13	26	13	11	15	41	14	07	50	36	27	52	14	51	58	16	07	14	14	59	49	43	12	37
	31	13	26	13	11	15	41	14	07	50	36	27	54	14	51	58	16	07	14	14	59	49	43	12	39
June	10	13	26	13	11	15	41	14	07	50	36	27	55	14	51	58	16	07	14	14	59	49	43	12	40
	20	13	26	13	11	15	40	14	07	50	36	27	55	14	51	58	16	07	14	14	59	49	43	12	41
	30	13	26	13	-11	15	40	14	07	50	-36	27	56	14	51	57	-16	07	14	14	59	49	-43	12	42
July	10	13	26	13	11	15	39	14	07	50	36	27	56	14	51	57	16	07	13	14	59	49	43	12	43
	20	13	26	13	11	15	39	14	07	50	36	27	56	14	51	57	16	07	13	14	59	49	43	12	44
	30	13	26	12	11	15	38	14	07	49	36	27	55	14	51	57	16	07	13	14	59	49	43	12	44
Aug.	9	13	26	12	11	15	37	14	07	49	36	27	55	14	51	57	16	07	12	14	59	48	43	12	44
	19	13	26	12	11	15	37	14	07	49	36	27	54	14	51	57	16	07	12	14	59	48	43	12	43
	29	13	26	12	-11	15	36	14	07	49	-36	27	53	14	51	57	-16	07	11	14	59	48	-43	12	43
Sept.	8	13	26	12	11	15	35	14	07	49	36	27	52	14	51	57	16	07	11	14	59	48	43	12	42
	18	13	26	12	11	15	35	14	07	49	36	27	50	14	51	56	16	07	10	14	59	48	43	12	40
	28	13	26	12	11	15	35	14	07	49	36	27	49	14	51	56	16	07	10	14	59	47	43	12	39
Oct.	8	13	26	12	11	15	35	14	07	48	36	27	48	14	51	56	16	07	10	14	59	47	43	12	38
	18	13	26	12	11	15	35	14	07	48	36	27	46	14	51	56	16	07	10	14	59	47	43	12	36
	28	13	26	12	-11	15	35	14	07	49	-36	27	45	14	51	56	-16	07	10	14	59	47	-43	12	34
Nov.	7	13	26	12	11	15	36	14	07	49	36	27	44	14	51	56	16	07	10	14	59	47	43	12	33
	17	13	26	12	11	15	37	14	07	49	36	27	44	14	51	56	16	07	10	14	59	47	43	12	32
	27	13	26	13	11	15	38	14	07	49	36	27	43	14	51	57	16	07	11	14	59	48	43	12	31
Dec.	7	13	26	13	11	15	40	14	07	49	36	27	43	14	51	57	16	07	12	14	59	48	43	12	30
	17	13	26	13	11	15	41	14	07	50	36	27	44	14	51	57	16	07	13	14	59	48	43	12	30
	27	13	26	14	-11	15	43	14	07	50	-36	27	44	14	51	57	-16	07	14	14	59	49	-43	12	30
	37	13	26	14	-11	15	45	14	07	50	-36	27	46	14	51	58	-16	07	16	14	59	49	-43	12	30

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		β Librae						α Serpentis						δ Scorpii						δ Ophiuchi					
Mag. Spect.		2.61			B8 IV			2.65			K2 III b			2.32			B0.2 Ive			2.74			M0.5 III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	15	18	00	-9	26	57	15	45	10	+6	22	05	16	01	25	-22	40	16	16	15	19	-3	44	24
	11	15	18	00	9	26	59	15	45	11	6	22	03	16	01	26	22	40	17	16	15	19	3	44	26
	21	15	18	01	9	27	01	15	45	11	6	22	01	16	01	26	22	40	18	16	15	19	3	44	27
	31	15	18	01	9	27	02	15	45	11	6	21	59	16	01	26	22	40	19	16	15	19	3	44	29
Feb.	10	15	18	01	9	27	04	15	45	12	6	21	58	16	01	27	22	40	20	16	15	20	3	44	30
	20	15	18	02	9	27	05	15	45	12	6	21	56	16	01	27	22	40	22	16	15	20	3	44	32
Mar.	2	15	18	02	-9	27	06	15	45	12	+6	21	56	16	01	27	-22	40	23	16	15	20	-3	44	32
	12	15	18	02	9	27	07	15	45	12	6	21	55	16	01	28	22	40	24	16	15	21	3	44	33
	22	15	18	02	9	27	08	15	45	13	6	21	55	16	01	28	22	40	25	16	15	21	3	44	34
Apr.	1	15	18	03	9	27	09	15	45	13	6	21	55	16	01	28	22	40	26	16	15	21	3	44	34
	11	15	18	03	9	27	09	15	45	13	6	21	56	16	01	29	22	40	26	16	15	21	3	44	34
	21	15	18	03	9	27	09	15	45	13	6	21	56	16	01	29	22	40	27	16	15	22	3	44	33
May	1	15	18	03	-9	27	09	15	45	14	+6	21	57	16	01	29	-22	40	28	16	15	22	-3	44	33
	11	15	18	03	9	27	09	15	45	14	6	21	58	16	01	29	22	40	28	16	15	22	3	44	32
	21	15	18	03	9	27	08	15	45	14	6	22	00	16	01	29	22	40	28	16	15	22	3	44	31
	31	15	18	03	9	27	08	15	45	14	6	22	01	16	01	29	22	40	29	16	15	22	3	44	31
June	10	15	18	04	9	27	08	15	45	14	6	22	02	16	01	29	22	40	29	16	15	22	3	44	30
	20	15	18	03	9	27	07	15	45	14	6	22	04	16	01	29	22	40	29	16	15	22	3	44	29
	30	15	18	03	-9	27	07	15	45	14	+6	22	05	16	01	29	-22	40	29	16	15	22	-3	44	28
July	10	15	18	03	9	27	07	15	45	14	6	22	06	16	01	29	22	40	30	16	15	22	3	44	28
	20	15	18	03	9	27	06	15	45	14	6	22	07	16	01	29	22	40	30	16	15	22	3	44	27
	30	15	18	03	9	27	06	15	45	14	6	22	07	16	01	29	22	40	30	16	15	22	3	44	26
Aug.	9	15	18	03	9	27	05	15	45	13	6	22	08	16	01	29	22	40	30	16	15	22	3	44	26
	19	15	18	03	9	27	05	15	45	13	6	22	08	16	01	29	22	40	30	16	15	22	3	44	26
	29	15	18	03	-9	27	05	15	45	13	+6	22	08	16	01	29	-22	40	29	16	15	22	-3	44	25
Sept.	8	15	18	03	9	27	04	15	45	13	6	22	08	16	01	29	22	40	29	16	15	22	3	44	25
	18	15	18	02	9	27	04	15	45	13	6	22	08	16	01	28	22	40	28	16	15	21	3	44	25
	28	15	18	02	9	27	04	15	45	13	6	22	08	16	01	28	22	40	28	16	15	21	3	44	25
Oct.	8	15	18	02	9	27	04	15	45	13	6	22	07	16	01	28	22	40	28	16	15	21	3	44	26
	18	15	18	02	9	27	04	15	45	12	6	22	06	16	01	28	22	40	27	16	15	21	3	44	26
	28	15	18	02	-9	27	05	15	45	12	+6	22	05	16	01	28	-22	40	27	16	15	21	-3	44	27
Nov.	7	15	18	02	9	27	05	15	45	12	6	22	03	16	01	28	22	40	27	16	15	21	3	44	28
	17	15	18	02	9	27	06	15	45	13	6	22	02	16	01	28	22	40	27	16	15	21	3	44	28
	27	15	18	02	9	27	07	15	45	13	6	22	00	16	01	28	22	40	27	16	15	21	3	44	30
Dec.	7	15	18	03	9	27	08	15	45	13	6	21	58	16	01	28	22	40	27	16	15	21	3	44	31
	17	15	18	03	9	27	10	15	45	13	6	21	56	16	01	29	22	40	27	16	15	21	3	44	33
	27	15	18	03	-9	27	11	15	45	13	+6	21	53	16	01	29	-22	40	28	16	15	21	-3	44	34
	37	15	18	03	-9	27	13	15	45	13	+6	21	51	16	01	29	-22	40	29	16	15	22	-3	44	36

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		α Scorpii A						ζ Ophiuchi						ε Scorpii						θ Ophiuchi					
Mag. Spect.		0.9 - 1.8			M1.5 Iab-b			2.56			O9V			2.29			K1 III			3.27			B2 IV		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	16	30	32	-26	28	10	16	38	10	-10	36	07	16	51	21	-34	19	22	17	23	08	-25	00	53
	11	16	30	32	26	28	11	16	38	11	10	36	08	16	51	22	34	19	22	17	23	08	25	00	53
	21	16	30	33	26	28	11	16	38	11	10	36	10	16	51	22	34	19	23	17	23	09	25	00	53
	31	16	30	33	26	28	12	16	38	11	10	36	11	16	51	22	34	19	23	17	23	09	25	00	54
Feb.	10	16	30	33	26	28	13	16	38	11	10	36	12	16	51	23	34	19	23	17	23	09	25	00	54
	20	16	30	34	26	28	14	16	38	12	10	36	13	16	51	23	34	19	24	17	23	10	25	00	55
Mar.	2	16	30	34	-26	28	15	16	38	12	-10	36	14	16	51	23	-34	19	24	17	23	10	-25	00	55
	12	16	30	34	26	28	15	16	38	12	10	36	15	16	51	24	34	19	25	17	23	10	25	00	56
	22	16	30	35	26	28	16	16	38	13	10	36	15	16	51	24	34	19	26	17	23	11	25	00	56
Apr.	1	16	30	35	26	28	17	16	38	13	10	36	16	16	51	24	34	19	27	17	23	11	25	00	56
	11	16	30	35	26	28	18	16	38	13	10	36	16	16	51	25	34	19	28	17	23	11	25	00	57
	21	16	30	36	26	28	18	16	38	13	10	36	16	16	51	25	34	19	28	17	23	12	25	00	57
May	1	16	30	36	-26	28	19	16	38	14	-10	36	15	16	51	25	-34	19	29	17	23	12	-25	00	57
	11	16	30	36	26	28	20	16	38	14	10	36	15	16	51	25	34	19	30	17	23	12	25	00	57
	21	16	30	36	26	28	20	16	38	14	10	36	14	16	51	26	34	19	31	17	23	12	25	00	57
	31	16	30	36	26	28	21	16	38	14	10	36	14	16	51	26	34	19	32	17	23	12	25	00	58
June	10	16	30	36	26	28	21	16	38	14	10	36	14	16	51	26	34	19	33	17	23	13	25	00	58
	20	16	30	37	26	28	22	16	38	14	10	36	13	16	51	26	34	19	34	17	23	13	25	00	58
	30	16	30	37	-26	28	22	16	38	14	-10	36	13	16	51	26	-34	19	34	17	23	13	-25	00	58
July	10	16	30	37	26	28	22	16	38	14	10	36	12	16	51	26	34	19	35	17	23	13	25	00	59
	20	16	30	36	26	28	23	16	38	14	10	36	12	16	51	26	34	19	36	17	23	13	25	01	01
	30	16	30	36	26	28	23	16	38	14	10	36	11	16	51	26	34	19	37	17	23	13	25	01	01
Aug.	9	16	30	36	26	28	23	16	38	14	10	36	11	16	51	26	34	19	37	17	23	13	25	01	01
	19	16	30	36	26	28	23	16	38	14	10	36	11	16	51	26	34	19	38	17	23	13	25	01	00
	29	16	30	36	-26	28	23	16	38	14	-10	36	11	16	51	25	-34	19	38	17	23	12	-25	01	00
Sept.	8	16	30	36	26	28	23	16	38	14	10	36	10	16	51	25	34	19	37	17	23	12	25	01	00
	18	16	30	36	26	28	22	16	38	13	10	36	10	16	51	25	34	19	37	17	23	12	25	01	00
	28	16	30	35	26	28	22	16	38	13	10	36	11	16	51	25	34	19	37	17	23	12	25	01	00
Oct.	8	16	30	35	26	28	22	16	38	13	10	36	11	16	51	25	34	19	36	17	23	12	25	01	00
	18	16	30	35	26	28	21	16	38	13	10	36	11	16	51	24	34	19	36	17	23	11	25	01	01
	28	16	30	35	-26	28	21	16	38	13	-10	36	11	16	51	24	-34	19	35	17	23	11	-25	01	01
Nov.	7	16	30	35	26	28	20	16	38	13	10	36	11	16	51	24	34	19	34	17	23	11	25	00	59
	17	16	30	35	26	28	20	16	38	13	10	36	12	16	51	24	34	19	33	17	23	11	25	00	59
	27	16	30	35	26	28	20	16	38	13	10	36	13	16	51	24	34	19	33	17	23	11	25	00	58
Dec.	7	16	30	35	26	28	20	16	38	13	10	36	14	16	51	24	34	19	32	17	23	11	25	00	59
	17	16	30	35	26	28	20	16	38	13	10	36	15	16	51	25	34	19	32	17	23	11	25	00	58
	27	16	30	36	-26	28	20	16	38	13	-10	36	16	16	51	25	-34	19	31	17	23	12	-25	00	58
	37	16	30	36	-26	28	20	16	38	14	-10	36	17	16	51	25	-34	19	31	17	23	12	-25	00	59

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		λ Scorpii						α Ophiuchi						β Ophiuchi						δ Sagittarii					
Mag. Spect.		1.63			B2 IV+			2.08			A5 III			2.77			K2 III			2.70			K3IIIa		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	17	34	51	-37	06	48	17	35	47	+12	32	54	17	44	23	+4	33	42	18	22	10	-29	49	01
	11	17	34	51	37	06	48	17	35	47	12	32	51	17	44	23	4	33	40	18	22	10	29	49	01
	21	17	34	52	37	06	48	17	35	47	12	32	49	17	44	23	4	33	38	18	22	10	29	49	01
	31	17	34	52	37	06	47	17	35	48	12	32	47	17	44	23	4	33	37	18	22	11	29	49	00
Feb.	10	17	34	52	37	06	47	17	35	48	12	32	45	17	44	23	4	33	35	18	22	11	29	49	00
	20	17	34	53	37	06	47	17	35	48	12	32	44	17	44	24	4	33	34	18	22	11	29	49	00
Mar.	2	17	34	53	-37	06	47	17	35	48	+12	32	43	17	44	24	+4	33	33	18	22	11	-29	49	00
	12	17	34	53	37	06	48	17	35	49	12	32	42	17	44	24	4	33	32	18	22	12	29	49	00
	22	17	34	54	37	06	48	17	35	49	12	32	42	17	44	25	4	33	32	18	22	12	29	49	00
Apr.	1	17	34	54	37	06	48	17	35	49	12	32	42	17	44	25	4	33	32	18	22	12	29	49	00
	11	17	34	55	37	06	49	17	35	49	12	32	43	17	44	25	4	33	33	18	22	13	29	49	01
	21	17	34	55	37	06	49	17	35	50	12	32	44	17	44	25	4	33	34	18	22	13	29	49	01
May	1	17	34	55	-37	06	50	17	35	50	+12	32	45	17	44	26	+4	33	35	18	22	13	-29	49	01
	11	17	34	56	37	06	51	17	35	50	12	32	47	17	44	26	4	33	36	18	22	14	29	49	01
	21	17	34	56	37	06	51	17	35	50	12	32	49	17	44	26	4	33	37	18	22	14	29	49	01
	31	17	34	56	37	06	52	17	35	51	12	32	50	17	44	26	4	33	39	18	22	14	29	49	00
June	10	17	34	56	37	06	53	17	35	51	12	32	52	17	44	26	4	33	40	18	22	15	29	49	00
	20	17	34	56	37	06	54	17	35	51	12	32	54	17	44	27	4	33	42	18	22	15	29	49	00
	30	17	34	56	-37	06	55	17	35	51	+12	32	56	17	44	27	+4	33	43	18	22	15	-29	49	01
July	10	17	34	56	37	06	56	17	35	51	12	32	58	17	44	27	4	33	45	18	22	15	29	49	01
	20	17	34	56	37	06	57	17	35	51	12	32	59	17	44	27	4	33	46	18	22	15	29	49	02
	30	17	34	56	37	06	58	17	35	51	12	33	01	17	44	27	4	33	47	18	22	15	29	49	02
Aug.	9	17	34	56	37	06	59	17	35	51	12	33	02	17	44	26	4	33	48	18	22	15	29	49	03
	19	17	34	56	37	07	01	17	35	51	12	33	03	17	44	26	4	33	48	18	22	15	29	49	04
	29	17	34	56	-37	07	00	17	35	50	+12	33	03	17	44	26	+4	33	49	18	22	15	-29	49	04
Sept.	8	17	34	56	37	07	00	17	35	50	12	33	04	17	44	26	4	33	49	18	22	15	29	49	04
	18	17	34	56	37	07	00	17	35	50	12	33	04	17	44	26	4	33	49	18	22	14	29	49	05
	28	17	34	55	37	07	00	17	35	50	12	33	03	17	44	26	4	33	49	18	22	14	29	49	05
Oct.	8	17	34	55	37	07	00	17	35	50	12	33	03	17	44	26	4	33	49	18	22	14	29	49	05
	18	17	34	55	37	07	01	17	35	50	12	33	02	17	44	25	4	33	48	18	22	14	29	49	05
	28	17	34	55	-37	06	59	17	35	49	+12	33	01	17	44	25	+4	33	48	18	22	14	-29	49	05
Nov.	7	17	34	55	37	06	58	17	35	49	12	33	00	17	44	25	4	33	47	18	22	13	29	49	05
	17	17	34	55	37	06	57	17	35	49	12	32	58	17	44	25	4	33	46	18	22	13	29	49	04
	27	17	34	55	37	06	56	17	35	49	12	32	56	17	44	25	4	33	44	18	22	13	29	49	04
Dec.	7	17	34	55	37	06	55	17	35	49	12	32	54	17	44	25	4	33	42	18	22	13	29	49	03
	17	17	34	55	37	06	55	17	35	49	12	32	52	17	44	25	4	33	41	18	22	13	29	49	03
	27	17	34	55	-37	06	54	17	35	49	+12	32	50	17	44	25	+4	33	39	18	22	14	-29	49	03
	37	17	34	55	-37	06	53	17	35	50	+12	32	47	17	44	25	+4	33	37	18	22	14	-29	49	02

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		ε Sagittarii						σ Sagittarii						ζ Aquilae						γ Aquilae					
Mag. Spect.		1.85			B9.5III			2.02			B2V			2.99			A0 Vn			2.72			G9.5IV		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	18	25	23	-34	22	21	18	56	24	-26	16	15	19	06	15	+13	53	37	19	47	08	+10	39	40
	11	18	25	23	34	22	21	18	56	24	26	16	15	19	06	15	13	53	34	19	47	08	10	39	38
	21	18	25	24	34	22	20	18	56	24	26	16	15	19	06	15	13	53	33	19	47	08	10	39	36
	31	18	25	24	34	22	20	18	56	24	26	16	15	19	06	15	13	53	30	19	47	08	10	39	35
Feb.	10	18	25	24	34	22	19	18	56	25	26	16	15	19	06	15	13	53	29	19	47	08	10	39	33
	20	18	25	24	34	22	19	18	56	25	26	16	14	19	06	16	13	53	27	19	47	08	10	39	32
Mar.	2	18	25	25	-34	22	19	18	56	25	-26	16	14	19	06	16	+13	53	26	19	47	08	+10	39	31
	12	18	25	25	34	22	19	18	56	26	26	16	14	19	06	16	13	53	25	19	47	09	10	39	30
	22	18	25	25	34	22	18	18	56	26	26	16	13	19	06	16	13	53	25	19	47	09	10	39	29
Apr.	1	18	25	26	34	22	18	18	56	26	26	16	13	19	06	17	13	53	25	19	47	09	10	39	29
	11	18	25	26	34	22	18	18	56	27	26	16	12	19	06	17	13	53	25	19	47	10	10	39	30
	21	18	25	26	34	22	18	18	56	27	26	16	12	19	06	17	13	53	26	19	47	10	10	39	31
May	1	18	25	27	-34	22	18	18	56	27	-26	16	12	19	06	18	+13	53	27	19	47	10	+10	39	32
	11	18	25	27	34	22	18	18	56	27	26	16	11	19	06	18	13	53	29	19	47	10	10	39	33
	21	18	25	27	34	22	18	18	56	28	26	16	11	19	06	18	13	53	31	19	47	11	10	39	35
	31	18	25	28	34	22	19	18	56	28	26	16	11	19	06	18	13	53	33	19	47	11	10	39	37
June	10	18	25	28	34	22	19	18	56	28	26	16	10	19	06	19	13	53	35	19	47	11	10	39	39
	20	18	25	28	34	22	20	18	56	29	26	16	10	19	06	19	13	53	37	19	47	11	10	39	41
	30	18	25	28	-34	22	21	18	56	29	-26	16	10	19	06	19	+13	53	39	19	47	12	+10	39	43
July	10	18	25	28	34	22	21	18	56	29	26	16	11	19	06	19	13	53	41	19	47	12	10	39	45
	20	18	25	28	34	22	22	18	56	29	26	16	11	19	06	19	13	53	43	19	47	12	10	39	47
	30	18	25	28	34	22	23	18	56	29	26	16	11	19	06	19	13	53	45	19	47	12	10	39	49
Aug.	9	18	25	28	34	22	24	18	56	29	26	16	12	19	06	19	13	53	46	19	47	12	10	39	50
	19	18	25	28	34	22	25	18	56	29	26	16	12	19	06	19	13	53	48	19	47	12	10	39	52
	29	18	25	28	-34	22	25	18	56	29	-26	16	13	19	06	19	+13	53	49	19	47	12	+10	39	53
Sept.	8	18	25	28	34	22	26	18	56	29	26	16	13	19	06	19	13	53	50	19	47	12	10	39	54
	18	18	25	28	34	22	26	18	56	28	26	16	14	19	06	19	13	53	50	19	47	12	10	39	54
	28	18	25	28	34	22	27	18	56	28	26	16	14	19	06	18	13	53	50	19	47	11	10	39	55
Oct.	8	18	25	27	34	22	27	18	56	28	26	16	14	19	06	18	13	53	51	19	47	11	10	39	55
	18	18	25	27	34	22	27	18	56	28	26	16	14	19	06	18	13	53	50	19	47	11	10	39	55
	28	18	25	27	-34	22	26	18	56	28	-26	16	15	19	06	18	+13	53	50	19	47	11	+10	39	54
Nov.	7	18	25	27	34	22	26	18	56	28	26	16	15	19	06	18	13	53	49	19	47	11	10	39	54
	17	18	25	27	34	22	25	18	56	27	26	16	14	19	06	18	13	53	48	19	47	11	10	39	53
	27	18	25	27	34	22	25	18	56	27	26	16	14	19	06	17	13	53	46	19	47	10	10	39	52
Dec.	7	18	25	27	34	22	24	18	56	27	26	16	14	19	06	17	13	53	44	19	47	10	10	39	50
	17	18	25	27	34	22	23	18	56	27	26	16	14	19	06	17	13	53	42	19	47	10	10	39	49
	27	18	25	27	-34	22	23	18	56	27	-26	16	14	19	06	17	+13	53	40	19	47	10	+10	39	47
	37	18	25	27	-34	22	22	18	56	28	-26	16	13	19	06	18	+13	53	38	19	47	10	+10	39	45

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		α Aquilae						γ Cygni						α Cygni						β Aquarii					
Mag. Spect.		0.77			A7 V			2.20			F8 I ab			1.25			A2 Iae			2.91			A1.5V		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	19	51	40	+8	55	12	20	22	53	+40	19	11	20	42	03	+45	21	03	21	32	32	-5	29	16
	11	19	51	41	8	55	10	20	22	53	40	19	08	20	42	03	45	21	00	21	32	32	5	29	17
	21	19	51	41	8	55	09	20	22	53	40	19	05	20	42	03	45	20	57	21	32	32	5	29	17
	31	19	51	41	8	55	07	20	22	53	40	19	02	20	42	03	45	20	54	21	32	32	5	29	18
Feb.	10	19	51	41	8	55	05	20	22	53	40	18	59	20	42	03	45	20	50	21	32	32	5	29	18
	20	19	51	41	8	55	04	20	22	53	40	18	57	20	42	03	45	20	48	21	32	32	5	29	18
Mar.	2	19	51	41	+8	55	03	20	22	53	+40	18	55	20	42	03	+45	20	45	21	32	32	-5	29	19
	12	19	51	42	8	55	02	20	22	53	40	18	52	20	42	03	45	20	43	21	32	32	5	29	19
	22	19	51	42	8	55	02	20	22	54	40	18	51	20	42	04	45	20	41	21	32	32	5	29	18
Apr.	1	19	51	42	8	55	02	20	22	54	40	18	50	20	42	04	45	20	40	21	32	32	5	29	17
	11	19	51	42	8	55	03	20	22	54	40	18	50	20	42	04	45	20	40	21	32	33	5	29	16
	21	19	51	43	8	55	04	20	22	55	40	18	50	20	42	05	45	20	40	21	32	33	5	29	15
May	1	19	51	43	+8	55	05	20	22	55	+40	18	51	20	42	05	+45	20	40	21	32	33	-5	29	14
	11	19	51	43	8	55	06	20	22	55	40	18	53	20	42	05	45	20	42	21	32	34	5	29	12
	21	19	51	44	8	55	08	20	22	56	40	18	55	20	42	06	45	20	43	21	32	34	5	29	11
	31	19	51	44	8	55	10	20	22	56	40	18	57	20	42	06	45	20	45	21	32	34	5	29	09
June	10	19	51	44	8	55	12	20	22	56	40	18	59	20	42	06	45	20	48	21	32	34	5	29	07
	20	19	51	44	8	55	14	20	22	57	40	19	02	20	42	07	45	20	51	21	32	35	5	29	06
	30	19	51	44	+8	55	16	20	22	57	+40	19	05	20	42	07	+45	20	54	21	32	35	-5	29	04
July	10	19	51	45	8	55	18	20	22	57	40	19	08	20	42	07	45	20	57	21	32	35	5	29	03
	20	19	51	45	8	55	20	20	22	57	40	19	12	20	42	07	45	21	01	21	32	35	5	29	01
	30	19	51	45	8	55	21	20	22	57	40	19	15	20	42	07	45	21	04	21	32	36	5	29	00
Aug.	9	19	51	45	8	55	23	20	22	57	40	19	18	20	42	07	45	21	07	21	32	36	5	28	59
	19	19	51	45	8	55	24	20	22	57	40	19	20	20	42	07	45	21	10	21	32	36	5	28	58
	29	19	51	45	+8	55	25	20	22	57	+40	19	23	20	42	07	+45	21	13	21	32	36	-5	28	58
Sept.	8	19	51	45	8	55	26	20	22	57	40	19	25	20	42	07	45	21	15	21	32	36	5	28	57
	18	19	51	44	8	55	27	20	22	57	40	19	27	20	42	07	45	21	17	21	32	36	5	28	57
	28	19	51	44	8	55	27	20	22	56	40	19	28	20	42	07	45	21	19	21	32	36	5	28	57
Oct.	8	19	51	44	8	55	27	20	22	56	40	19	30	20	42	07	45	21	21	21	32	36	5	28	57
	18	19	51	44	8	55	27	20	22	56	40	19	30	20	42	06	45	21	22	21	32	35	5	28	58
	28	19	51	44	+8	55	26	20	22	56	+40	19	30	20	42	06	+45	21	22	21	32	35	-5	28	58
Nov.	7	19	51	44	8	55	26	20	22	55	40	19	30	20	42	06	45	21	22	21	32	35	5	28	59
	17	19	51	43	8	55	25	20	22	55	40	19	29	20	42	05	45	21	21	21	32	35	5	29	01
	27	19	51	43	8	55	24	20	22	55	40	19	28	20	42	05	45	21	20	21	32	35	5	29	00
Dec.	7	19	51	43	8	55	23	20	22	55	40	19	26	20	42	05	45	21	19	21	32	35	5	29	01
	17	19	51	43	8	55	21	20	22	55	40	19	24	20	42	05	45	21	17	21	32	35	5	29	01
	27	19	51	43	+8	55	20	20	22	55	+40	19	22	20	42	05	+45	21	14	21	32	35	-5	29	02
	37	19	51	43	+8	55	18	20	22	55	+40	19	19	20	42	05	+45	21	12	21	32	35	-5	29	03

APPARENT PLACES OF STARS, 2019

FOR 0^h TERRESTRIAL TIME

Name		ε Pegasi						α Aquarii						δ Aquarii						α Pegasi					
Mag. Spect.		0.7 - 3.5			K2 Ib			2.96			G2 Ib			3.27			A3 V			2.49			B9III		
U.T.		Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
		h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
Jan.	1	21	45	05	+9	57	45	22	06	44	-0	13	40	22	55	38	-15	43	20	23	05	41	+15	18	27
	11	21	45	05	9	57	44	22	06	44	0	13	41	22	55	38	15	43	20	23	05	41	15	18	26
	21	21	45	05	9	57	43	22	06	44	0	13	42	22	55	38	15	43	20	23	05	41	15	18	25
	31	21	45	05	9	57	41	22	06	44	0	13	43	22	55	38	15	43	20	23	05	41	15	18	23
Feb.	10	21	45	05	9	57	40	22	06	44	0	13	44	22	55	38	15	43	20	23	05	41	15	18	22
	20	21	45	05	9	57	39	22	06	44	0	13	44	22	55	38	15	43	19	23	05	41	15	18	21
Mar.	2	21	45	06	+9	57	38	22	06	44	-0	13	44	22	55	38	-15	43	18	23	05	41	+15	18	20
	12	21	45	06	9	57	37	22	06	44	0	13	45	22	55	38	15	43	18	23	05	41	15	18	19
	22	21	45	06	9	57	37	22	06	44	0	13	44	22	55	38	15	43	16	23	05	41	15	18	18
Apr.	1	21	45	06	9	57	37	22	06	44	0	13	44	22	55	38	15	43	15	23	05	41	15	18	18
	11	21	45	06	9	57	37	22	06	45	0	13	43	22	55	38	15	43	13	23	05	41	15	18	17
	21	21	45	07	9	57	37	22	06	45	0	13	42	22	55	38	15	43	12	23	05	42	15	18	18
May	1	21	45	07	+9	57	38	22	06	45	-0	13	41	22	55	39	-15	43	10	23	05	42	+15	18	18
	11	21	45	07	9	57	40	22	06	45	0	13	39	22	55	39	15	43	08	23	05	42	15	18	19
	21	21	45	07	9	57	41	22	06	46	0	13	38	22	55	39	15	43	06	23	05	42	15	18	21
	31	21	45	08	9	57	43	22	06	46	0	13	36	22	55	39	15	43	04	23	05	43	15	18	22
June	10	21	45	08	9	57	45	22	06	46	0	13	34	22	55	40	15	43	02	23	05	43	15	18	24
	20	21	45	08	9	57	47	22	06	47	0	13	32	22	55	40	15	43	00	23	05	43	15	18	26
	30	21	45	09	+9	57	49	22	06	47	-0	13	30	22	55	40	-15	42	59	23	05	44	+15	18	28
July	10	21	45	09	9	57	52	22	06	47	0	13	28	22	55	41	15	42	57	23	05	44	15	18	31
	20	21	45	09	9	57	54	22	06	47	0	13	26	22	55	41	15	42	56	23	05	44	15	18	33
	30	21	45	09	9	57	56	22	06	48	0	13	25	22	55	41	15	42	55	23	05	44	15	18	35
Aug.	9	21	45	09	9	57	58	22	06	48	0	13	24	22	55	41	15	42	54	23	05	45	15	18	37
	19	21	45	09	9	57	59	22	06	48	0	13	23	22	55	42	15	42	54	23	05	45	15	18	39
	29	21	45	09	+9	58	01	22	06	48	-0	13	21	22	55	42	-15	42	54	23	05	45	+15	18	41
Sept.	8	21	45	09	9	58	02	22	06	48	0	13	21	22	55	42	15	42	54	23	05	45	15	18	43
	18	21	45	09	9	58	03	22	06	48	0	13	20	22	55	42	15	42	54	23	05	45	15	18	44
	28	21	45	09	9	58	04	22	06	48	0	13	20	22	55	42	15	42	55	23	05	45	15	18	46
Oct.	8	21	45	09	9	58	04	22	06	48	0	13	20	22	55	42	15	42	56	23	05	45	15	18	47
	18	21	45	09	9	58	05	22	06	48	0	13	20	22	55	42	15	42	57	23	05	45	15	18	47
	28	21	45	09	+9	58	05	22	06	48	-0	13	20	22	55	42	-15	42	58	23	05	45	+15	18	48
Nov.	7	21	45	09	9	58	04	22	06	47	0	13	21	22	55	42	15	42	58	23	05	45	15	18	48
	17	21	45	09	9	58	04	22	06	47	0	13	21	22	55	41	15	43	01	23	05	45	15	18	48
	27	21	45	09	9	58	03	22	06	47	0	13	22	22	55	41	15	43	00	23	05	44	15	18	48
Dec.	7	21	45	08	9	58	02	22	06	47	0	13	23	22	55	41	15	43	01	23	05	44	15	18	47
	17	21	45	08	9	58	02	22	06	47	0	13	23	22	55	41	15	43	01	23	05	44	15	18	47
	27	21	45	08	+9	58	00	22	06	47	-0	13	24	22	55	41	-15	43	02	23	05	44	+15	18	46
	37	21	45	08	+9	57	59	22	06	47	-0	13	25	22	55	41	-15	43	02	23	05	44	+15	18	45

BESSELIAN DAY NUMBERS, 2019.5
FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Jan.	0	-0.5034	-16.087	+4.696	-3.087	+20.576	-20	-0.090	+0.071
	1	0.5007	16.035	4.717	3.418	20.515	20	0.137	+0.035
	2	0.4979	15.967	4.742	3.748	20.449	20	0.145	-0.005
	3	0.4952	15.885	4.762	4.077	20.375	19	0.115	0.042
	4	0.4925	15.791	4.772	4.405	20.294	19	0.056	0.068
	5	0.4897	15.692	4.767	4.732	20.207	19	+0.017	0.081
	6	-0.4870	-15.593	+4.747	-5.057	+20.114	-19	+0.091	-0.079
	7	0.4843	15.500	4.711	5.380	20.013	19	0.151	0.062
	8	0.4815	15.418	4.665	5.701	19.906	19	0.185	0.035
	9	0.4788	15.349	4.612	6.021	19.793	19	0.187	-0.002
	10	0.4760	15.293	4.558	6.338	19.673	19	0.155	+0.031
	11	0.4733	15.251	4.509	6.653	19.547	19	0.092	0.059
	12	-0.4706	-15.218	+4.469	-6.965	+19.415	-19	+0.006	+0.077
	13	0.4678	15.190	4.442	7.275	19.276	19	-0.091	0.081
	14	0.4651	15.161	4.431	7.583	19.132	19	0.185	0.069
	15	0.4624	15.125	4.434	7.887	18.982	19	0.259	0.043
	16	0.4596	15.074	4.448	8.189	18.826	19	0.296	+0.005
	17	0.4569	15.005	4.467	8.487	18.665	19	0.285	-0.038
	18	-0.4541	-14.915	+4.482	-8.783	+18.498	-19	-0.220	-0.078
	19	0.4514	14.807	4.480	9.076	18.326	19	-0.109	0.101
	20	0.4487	14.690	4.455	9.366	18.149	19	+0.027	0.102
	21	0.4459	14.578	4.403	9.653	17.967	18	0.153	0.076
	22	0.4432	14.483	4.330	9.937	17.780	18	0.235	-0.029
	23	0.4405	14.414	4.250	10.218	17.588	18	0.255	+0.024
	24	-0.4377	-14.371	+4.177	-10.497	+17.391	-18	+0.211	+0.070
	25	0.4350	14.345	4.123	10.773	17.188	18	0.125	0.097
	26	0.4322	14.326	4.093	11.046	16.981	18	+0.025	0.100
	27	0.4295	14.302	4.084	11.315	16.768	19	-0.063	0.081
	28	0.4268	14.266	4.090	11.582	16.549	19	0.119	0.047
	29	0.4240	14.215	4.103	11.845	16.325	19	0.135	+0.007
	30	-0.4213	-14.150	+4.113	-12.105	+16.096	-19	-0.112	-0.032
	31	0.4185	14.072	4.114	12.361	15.862	19	-0.059	0.061
Feb.	1	0.4158	13.989	4.102	12.613	15.622	18	+0.012	0.078
	2	0.4131	13.905	4.075	12.860	15.378	18	0.086	0.079
	3	0.4103	13.826	4.034	13.104	15.128	18	0.150	0.066
	4	0.4076	13.756	3.981	13.344	14.873	18	0.190	0.042
	5	-0.4049	-13.699	+3.921	-13.579	+14.614	-18	+0.201	-0.010
	6	0.4021	13.657	3.859	13.809	14.350	18	0.177	+0.023
	7	0.3994	13.627	3.801	14.035	14.081	18	0.121	0.053
	8	0.3966	13.609	3.752	14.256	13.809	18	+0.040	0.074
	9	0.3939	13.597	3.716	14.472	13.532	19	-0.055	0.081
	10	0.3912	13.586	3.695	14.683	13.251	19	0.152	0.074
	11	-0.3884	-13.570	+3.690	-14.889	+12.966	-19	-0.233	+0.052
	12	0.3857	13.542	3.696	15.090	12.677	19	0.284	+0.018
	13	0.3830	13.498	3.709	15.286	12.385	19	0.294	-0.023
	14	0.3802	13.436	3.722	15.477	12.090	19	0.254	0.063
	15	-0.3775	-13.355	+3.725	-15.663	+11.791	-19	-0.168	-0.093

BESSELIAN DAY NUMBERS, 2019.5
FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Feb.	15	-0.3775	-13.355	+3.725	-15.663	+11.791	-19	-0.168	-0.093
	16	0.3747	13.262	3.710	15.844	11.490	19	-0.048	0.104
	17	0.3720	13.166	3.670	16.020	11.185	19	+0.080	0.091
	18	0.3693	13.081	3.607	16.191	10.878	19	0.184	0.053
	19	0.3665	13.016	3.529	16.358	10.569	19	0.235	-0.001
	20	0.3638	12.979	3.451	16.519	10.257	19	0.221	+0.051
	21	-0.3611	-12.964	+3.388	-16.676	+9.942	-19	+0.151	+0.089
	22	0.3583	12.961	3.349	16.829	9.624	19	+0.052	0.104
	23	0.3556	12.958	3.337	16.976	9.303	19	-0.043	0.092
	24	0.3528	12.944	3.345	17.119	8.980	19	0.111	0.061
	25	0.3501	12.913	3.363	17.257	8.654	19	0.136	+0.019
	26	0.3474	12.867	3.381	17.390	8.325	19	0.120	-0.022
	27	-0.3446	-12.807	+3.392	-17.517	+7.993	-19	-0.069	-0.055
	28	0.3419	12.739	3.391	17.639	7.658	19	+0.003	0.075
Mar.	1	0.3392	12.670	3.375	17.756	7.322	19	0.081	0.080
	2	0.3364	12.604	3.344	17.867	6.982	19	0.149	0.070
	3	0.3337	12.547	3.302	17.972	6.641	19	0.196	0.047
	4	0.3309	12.503	3.252	18.071	6.298	19	0.214	-0.017
	5	-0.3282	-12.472	+3.200	-18.165	+5.952	-19	+0.199	+0.017
	6	0.3255	12.454	3.151	18.253	5.605	19	0.151	0.048
	7	0.3227	12.448	3.110	18.335	5.256	20	+0.075	0.071
	8	0.3200	12.449	3.083	18.411	4.906	20	-0.019	0.082
	9	0.3172	12.452	3.070	18.481	4.555	20	0.117	0.079
	10	0.3145	12.450	3.074	18.545	4.203	20	0.203	0.060
	11	-0.3118	-12.439	+3.090	-18.603	+3.850	-20	-0.263	+0.028
	12	0.3090	12.412	3.116	18.655	3.496	20	0.285	-0.011
	13	0.3063	12.367	3.142	18.701	3.142	20	0.261	0.051
	14	0.3036	12.305	3.162	18.741	2.787	20	0.193	0.084
	15	0.3008	12.230	3.167	18.776	2.432	20	-0.090	0.101
	16	0.2981	12.148	3.152	18.805	2.078	20	+0.028	0.097
	17	-0.2953	-12.071	+3.114	-18.828	+1.723	-20	+0.135	-0.070
	18	0.2926	12.009	3.058	18.845	1.369	20	0.204	-0.024
	19	0.2899	11.970	2.996	18.858	1.015	20	0.215	+0.028
	20	0.2871	11.955	2.942	18.865	0.662	20	0.168	0.074
	21	0.2844	-11.956	+2.908	-18.867	+0.308	20	+0.078	0.100
	22	0.2817	11.962	2.901	18.864	-0.045	21	-0.024	0.100
	23	-0.2789	-11.961	+2.919	-18.856	-0.398	-21	-0.107	+0.076
	24	0.2762	11.943	2.953	18.842	0.751	21	0.149	+0.036
	25	0.2734	11.906	2.992	18.824	1.103	21	0.144	-0.009
	26	0.2707	11.853	3.026	18.799	1.456	21	0.097	0.047
	27	0.2680	11.789	3.047	18.770	1.808	21	-0.024	0.072
	28	0.2652	11.721	3.054	18.735	2.160	21	+0.060	0.082
	29	-0.2625	-11.655	+3.045	-18.694	-2.511	-21	+0.137	-0.075
	30	0.2598	11.597	3.023	18.647	2.861	21	0.194	0.055
	31	0.2570	11.550	2.992	18.595	3.211	21	0.222	-0.026
Apr.	1	0.2543	11.517	2.958	18.537	3.560	21	0.217	+0.009
	2	-0.2515	-11.497	+2.925	-18.473	-3.907	-21	+0.177	+0.041

BESSELIAN DAY NUMBERS, 2019.5
FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Apr.	1	-0.2543	-11.517	+2.958	-18.537	-3.560	-21	+0.217	+0.009
	2	0.2515	11.497	2.925	18.473	3.907	21	0.177	0.041
	3	0.2488	11.489	2.899	18.404	4.253	21	0.107	0.068
	4	0.2461	11.488	2.886	18.329	4.598	21	+0.016	0.083
	5	0.2433	11.491	2.887	18.248	4.941	22	-0.083	0.083
	6	0.2406	11.490	2.905	18.161	5.283	22	0.175	0.068
	7	-0.2379	-11.480	+2.937	-18.069	-5.622	-22	-0.242	+0.038
	8	0.2351	11.454	2.979	17.971	5.959	22	0.273	-0.000
	9	0.2324	11.411	3.025	17.868	6.294	22	0.260	0.041
	10	0.2296	11.349	3.064	17.760	6.626	22	0.201	0.076
	11	0.2269	11.272	3.091	17.646	6.956	22	-0.107	0.097
	12	0.2242	11.189	3.097	17.527	7.283	22	+0.005	0.099
	13	-0.2214	-11.107	+3.083	-17.403	-7.607	-22	+0.110	-0.078
	14	0.2187	11.037	3.050	17.274	7.927	22	0.185	-0.039
	15	0.2159	10.986	3.008	17.140	8.245	22	0.211	+0.010
	16	0.2132	10.957	2.968	17.002	8.560	22	0.180	0.058
	17	0.2105	10.946	2.942	16.860	8.872	22	0.103	0.091
	18	0.2077	10.944	2.940	16.713	9.181	22	+0.002	0.102
	19	-0.2050	-10.939	+2.963	-16.562	-9.487	-22	-0.093	+0.087
	20	0.2023	10.921	3.006	16.407	9.791	23	0.155	0.053
	21	0.1995	10.883	3.060	16.248	10.091	23	0.170	+0.008
	22	0.1968	10.826	3.113	16.084	10.389	23	0.136	-0.035
	23	0.1940	10.753	3.155	15.915	10.684	23	-0.067	0.067
	24	0.1913	10.673	3.181	15.743	10.976	22	+0.021	0.083
	25	-0.1886	-10.593	+3.190	-15.565	-11.265	-22	+0.108	-0.082
	26	0.1858	10.518	3.183	15.384	11.551	22	0.178	0.065
	27	0.1831	10.455	3.166	15.197	11.834	22	0.219	0.037
	28	0.1804	10.405	3.143	15.007	12.113	22	0.225	-0.003
	29	0.1776	10.369	3.119	14.811	12.389	22	0.196	+0.032
	30	0.1749	10.345	3.100	14.612	12.661	22	0.134	0.062
May	1	-0.1721	-10.330	+3.092	-14.408	-12.929	-23	+0.048	+0.081
	2	0.1694	10.319	3.098	14.199	13.194	23	-0.051	0.086
	3	0.1667	10.307	3.120	13.986	13.454	23	0.147	0.075
	4	0.1639	10.287	3.157	13.769	13.711	23	0.225	0.050
	5	0.1612	10.252	3.206	13.548	13.963	23	0.267	+0.012
	6	0.1585	10.199	3.260	13.323	14.210	23	0.265	-0.030
	7	-0.1557	-10.126	+3.309	-13.094	-14.453	-23	-0.214	-0.068
	8	0.1530	10.036	3.346	12.861	14.691	23	0.123	0.094
	9	0.1502	9.938	3.364	12.625	14.924	23	-0.010	0.101
	10	0.1475	9.839	3.359	12.385	15.152	23	+0.100	0.085
	11	0.1448	9.751	3.335	12.142	15.375	22	0.183	0.049
	12	0.1420	9.681	3.299	11.895	15.594	22	0.219	-0.002
	13	-0.1393	-9.632	+3.261	-11.646	-15.807	-22	+0.200	+0.046
	14	0.1366	9.602	3.235	11.395	16.015	23	0.132	0.083
	15	0.1338	9.584	3.228	11.140	16.219	23	+0.035	0.100
	16	0.1311	9.566	3.244	10.883	16.417	23	-0.066	0.094
	17	-0.1283	-9.538	+3.282	-10.624	-16.612	-23	-0.143	+0.066

BESSELIAN DAY NUMBERS, 2019.5
FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
May	17	-0.1283	-9.538	+3.282	-10.624	-16.612	-23	-0.143	+0.066
	18	0.1256	9.493	3.333	10.362	16.801	23	0.178	+0.025
	19	0.1229	9.428	3.387	10.097	16.986	23	0.165	-0.020
	20	0.1201	9.346	3.434	9.830	17.167	23	0.108	0.058
	21	0.1174	9.252	3.466	9.561	17.342	23	-0.024	0.081
	22	0.1146	9.154	3.480	9.289	17.514	22	+0.068	0.087
	23	-0.1119	-9.060	+3.476	-9.014	-17.680	-22	+0.149	-0.075
	24	0.1092	8.977	3.459	8.737	17.842	22	0.204	0.050
	25	0.1064	8.906	3.432	8.457	17.999	22	0.224	-0.016
	26	0.1037	8.850	3.403	8.174	18.151	22	0.208	+0.020
	27	0.1010	8.807	3.377	7.889	18.298	22	0.156	0.052
	28	0.0982	8.775	3.360	7.602	18.440	22	+0.076	0.076
	29	-0.0955	-8.749	+3.354	-7.313	-18.576	-22	-0.020	+0.086
	30	0.0927	8.724	3.365	7.021	18.707	23	0.120	0.081
	31	0.0900	8.693	3.390	6.726	18.833	23	0.206	0.060
June	1	0.0873	8.650	3.429	6.430	18.953	23	0.263	+0.026
	2	0.0845	8.590	3.475	6.132	19.067	23	0.276	-0.016
	3	0.0818	8.509	3.519	5.832	19.176	23	0.240	0.058
	4	-0.0791	-8.410	+3.554	-5.530	-19.279	-22	-0.156	-0.090
	5	0.0763	8.298	3.569	5.227	19.375	22	-0.041	0.103
	6	0.0736	8.183	3.560	4.922	19.466	22	+0.079	0.093
	7	0.0708	8.076	3.529	4.616	19.551	22	0.177	0.061
	8	0.0681	7.988	3.483	4.309	19.629	22	0.229	-0.015
	9	0.0654	7.922	3.433	4.002	19.702	22	0.224	+0.035
	10	-0.0626	-7.877	+3.391	-3.694	-19.769	-22	+0.166	+0.076
	11	0.0599	7.846	3.367	3.385	19.830	22	+0.073	0.099
	12	0.0572	7.819	3.366	3.076	19.886	22	-0.030	0.098
	13	0.0544	7.785	3.385	2.767	19.936	22	0.117	0.076
	14	0.0517	7.736	3.420	2.457	19.980	22	0.167	+0.038
	15	0.0489	7.669	3.460	2.147	20.019	22	0.171	-0.006
	16	-0.0462	-7.584	+3.496	-1.837	-20.053	-22	-0.130	-0.046
	17	0.0435	7.485	3.520	1.527	20.082	22	-0.056	0.075
	18	0.0407	7.381	3.526	1.216	20.106	22	+0.033	0.087
	19	0.0380	7.278	3.514	0.905	20.124	21	0.118	0.081
	20	0.0352	7.182	3.486	0.593	20.137	21	0.184	0.060
	21	0.0325	7.100	3.447	-0.281	20.144	21	0.218	-0.029
	22	-0.0298	-7.032	+3.403	+0.031	-20.147	-21	+0.214	+0.007
	23	0.0270	6.979	3.360	0.343	20.143	21	0.174	0.041
	24	0.0243	6.938	3.323	0.655	20.135	21	0.102	0.068
	25	0.0216	6.906	3.298	0.968	20.120	21	+0.010	0.083
	26	0.0188	6.876	3.286	1.281	20.100	21	-0.091	0.084
	27	0.0161	6.845	3.290	1.593	20.074	21	0.184	0.069
	28	-0.0133	-6.803	+3.308	+1.905	-20.043	-21	-0.254	+0.039
	29	0.0106	6.747	3.335	2.218	20.005	22	0.286	-0.001
	30	0.0079	6.672	3.365	2.529	19.962	22	0.270	0.044
July	1	0.0051	6.577	3.389	2.841	19.913	22	0.203	0.081
	2	-0.0024	-6.466	+3.396	+3.151	-19.857	-22	-0.095	-0.103

BESSELIAN DAY NUMBERS, 2019.5
FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
July	1	-0.0051	-6.577	+3.389	+2.841	-19.913	-22	-0.203	-0.081
	2	-0.0024	6.466	3.396	3.151	19.857	22	-0.095	0.103
	3	+0.0003	6.347	3.379	3.461	19.796	22	+0.033	0.102
	4	0.0031	6.233	3.338	3.770	19.728	22	0.149	0.076
	5	0.0058	6.135	3.277	4.077	19.655	20	0.224	-0.031
	6	0.0086	6.061	3.208	4.383	19.575	20	0.241	+0.021
	7	+0.0113	-6.011	+3.144	+4.687	-19.490	-20	+0.198	+0.068
	8	0.0140	5.979	3.097	4.989	19.399	20	0.112	0.097
	9	0.0168	5.953	3.073	5.290	19.302	21	+0.008	0.102
	10	0.0195	5.924	3.072	5.588	19.200	21	-0.085	0.085
	11	0.0222	5.882	3.087	5.885	19.093	21	0.145	0.050
	12	0.0250	5.823	3.110	6.179	18.981	21	0.162	+0.007
	13	+0.0277	-5.747	+3.131	+6.472	-18.864	-21	-0.134	-0.035
	14	0.0305	5.656	3.142	6.763	18.742	21	-0.070	0.067
	15	0.0332	5.559	3.138	7.052	18.615	20	+0.013	0.084
	16	0.0359	5.461	3.116	7.339	18.484	20	0.099	0.083
	17	0.0387	5.369	3.077	7.624	18.347	20	0.170	0.067
	18	0.0414	5.288	3.026	7.907	18.206	20	0.213	0.039
	19	+0.0441	-5.222	+2.968	+8.188	-18.060	-20	+0.220	-0.004
	20	0.0469	5.172	2.910	8.467	17.909	20	0.190	+0.031
	21	0.0496	5.135	2.856	8.745	17.752	20	0.127	0.060
	22	0.0524	5.108	2.813	9.020	17.591	20	+0.040	0.079
	23	0.0551	5.087	2.783	9.293	17.426	20	-0.060	0.085
	24	0.0578	5.065	2.769	9.563	17.255	20	0.158	0.074
	25	+0.0606	-5.037	+2.768	+9.832	-17.079	-20	-0.238	+0.050
	26	0.0633	4.997	2.779	10.098	16.898	21	0.285	+0.014
	27	0.0661	4.939	2.795	10.362	16.712	21	0.290	-0.028
	28	0.0688	4.863	2.809	10.623	16.520	20	0.246	0.069
	29	0.0715	4.770	2.812	10.881	16.324	20	0.156	0.098
	30	0.0743	4.664	2.795	11.136	16.123	20	-0.034	0.107
	31	+0.0770	-4.557	+2.753	+11.389	-15.916	-20	+0.092	-0.091
Aug.	1	0.0797	4.461	2.687	11.637	15.704	20	0.191	-0.052
	2	0.0825	4.387	2.607	11.883	15.487	20	0.237	+0.001
	3	0.0852	4.339	2.528	12.125	15.266	20	0.218	0.054
	4	0.0880	4.314	2.463	12.363	15.040	20	0.144	0.091
	5	0.0907	4.300	2.421	12.597	14.809	20	+0.043	0.105
	6	+0.0934	-4.286	+2.406	+12.827	-14.574	-20	-0.056	+0.094
	7	0.0962	4.261	2.411	13.053	14.335	20	0.126	0.062
	8	0.0989	4.218	2.426	13.275	14.093	20	0.152	+0.019
	9	0.1016	4.159	2.442	13.493	13.846	20	0.132	-0.024
	10	0.1044	4.085	2.449	13.707	13.596	20	-0.075	0.059
	11	0.1071	4.002	2.443	13.918	13.343	20	+0.005	0.080
	12	+0.1099	-3.918	+2.419	+14.124	-13.086	-20	+0.091	-0.084
	13	0.1126	3.839	2.380	14.327	12.825	20	0.165	0.071
	14	0.1153	3.770	2.327	14.526	12.561	20	0.215	0.045
	15	0.1181	3.715	2.267	14.721	12.294	20	0.230	-0.012
	16	+0.1208	-3.676	+2.205	+14.913	-12.023	-20	+0.210	+0.023

BESSELIAN DAY NUMBERS, 2019.5
FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Aug.	16	+0.1208	-3.676	+2.205	+14.913	-12.023	-20	+0.210	+0.023
	17	0.1235	3.650	2.148	15.100	11.749	20	0.154	0.054
	18	0.1263	3.636	2.099	15.284	11.471	20	+0.072	0.076
	19	0.1290	3.629	2.064	15.464	11.190	20	-0.026	0.085
	20	0.1318	3.623	2.044	15.640	10.906	21	0.126	0.079
	21	0.1345	3.612	2.040	15.812	10.618	21	0.213	0.058
	22	+0.1372	-3.591	+2.047	+15.979	-10.327	-21	-0.273	+0.025
	23	0.1400	3.555	2.062	16.143	10.032	21	0.294	-0.015
	24	0.1427	3.502	2.077	16.302	9.735	21	0.269	0.055
	25	0.1454	3.431	2.086	16.457	9.434	21	0.200	0.088
	26	0.1482	3.346	2.079	16.607	9.129	21	-0.096	0.105
	27	0.1509	3.256	2.050	16.753	8.821	21	+0.026	0.100
	28	+0.1537	-3.170	+1.998	+16.894	-8.510	-20	+0.137	-0.071
	29	0.1564	3.100	1.927	17.030	8.196	20	0.207	-0.023
	30	0.1591	3.055	1.849	17.161	7.879	20	0.218	+0.032
	31	0.1619	3.035	1.780	17.286	7.559	21	0.166	0.079
Sept.	1	0.1646	3.032	1.733	17.406	7.237	21	+0.072	0.104
	2	0.1674	3.034	1.714	17.521	6.912	21	-0.033	0.102
	3	+0.1701	-3.027	+1.720	+17.630	-6.585	-21	-0.114	+0.075
	4	0.1728	3.003	1.742	17.733	6.256	21	0.152	+0.033
	5	0.1756	2.960	1.769	17.832	5.926	21	0.140	-0.013
	6	0.1783	2.900	1.788	17.925	5.594	21	0.087	0.052
	7	0.1810	2.830	1.794	18.013	5.261	21	-0.006	0.076
	8	0.1838	2.757	1.783	18.096	4.927	21	+0.083	0.084
	9	+0.1865	-2.688	+1.756	+18.174	-4.591	-21	+0.163	-0.075
	10	0.1893	2.628	1.716	18.246	4.254	21	0.220	0.052
	11	0.1920	2.581	1.668	18.314	3.915	21	0.244	-0.019
	12	0.1947	2.549	1.616	18.377	3.576	21	0.231	+0.016
	13	0.1975	2.532	1.568	18.434	3.235	21	0.183	0.049
	14	0.2002	2.527	1.529	18.487	2.894	21	0.106	0.074
	15	+0.2029	-2.529	+1.503	+18.535	-2.551	-22	+0.010	+0.086
	16	0.2057	2.533	1.492	18.578	2.207	22	-0.092	0.083
	17	0.2084	2.534	1.497	18.615	1.863	22	0.184	0.066
	18	0.2112	2.525	1.515	18.648	1.517	22	0.252	+0.036
	19	0.2139	2.502	1.542	18.675	1.171	22	0.284	-0.003
	20	0.2166	2.463	1.572	18.698	0.823	22	0.274	0.043
	21	+0.2194	-2.406	+1.597	+18.715	-0.475	-22	-0.221	-0.078
	22	0.2221	2.335	1.610	18.726	-0.126	22	0.132	0.100
	23	0.2248	2.256	1.604	18.733	+0.224	22	-0.022	0.103
	24	0.2276	2.177	1.577	18.734	0.575	22	+0.087	0.084
	25	0.2303	2.109	1.530	18.729	0.926	22	0.169	-0.044
	26	0.2331	2.061	1.471	18.718	1.278	22	0.202	+0.008
	27	+0.2358	-2.036	+1.413	+18.702	+1.630	-22	+0.175	+0.059
	28	0.2385	2.032	1.372	18.679	1.982	22	+0.096	0.095
	29	0.2413	2.038	1.356	18.650	2.334	23	-0.009	0.106
	30	0.2440	2.040	1.369	18.616	2.685	23	0.105	0.089
Oct.	1	+0.2467	-2.026	+1.405	+18.575	+3.036	-23	-0.162	+0.050

BESSELIAN DAY NUMBERS, 2019.5
FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Oct.	1	+0.2467	-2.026	+1.405	+18.575	+3.036	-23	-0.162	+0.050
	2	0.2495	1.991	1.450	18.529	3.386	23	0.165	+0.002
	3	0.2522	1.936	1.492	18.476	3.734	23	0.118	-0.042
	4	0.2550	1.867	1.521	18.418	4.081	23	-0.036	0.073
	5	0.2577	1.792	1.533	18.355	4.427	23	+0.060	0.086
	6	0.2604	1.719	1.528	18.286	4.772	23	0.150	0.080
	7	+0.2632	-1.654	+1.507	+18.212	+5.115	-23	+0.218	-0.059
	8	0.2659	1.603	1.477	18.133	5.456	23	0.253	-0.028
	9	0.2687	1.565	1.443	18.048	5.796	23	0.251	+0.008
	10	0.2714	1.543	1.410	17.959	6.134	23	0.211	0.043
	11	0.2741	1.532	1.385	17.864	6.471	23	0.140	0.070
	12	0.2769	1.530	1.373	17.764	6.806	23	+0.047	0.086
	13	+0.2796	-1.532	+1.375	+17.659	+7.139	-23	-0.056	+0.088
	14	0.2823	1.530	1.394	17.549	7.470	24	0.152	0.074
	15	0.2851	1.520	1.426	17.435	7.799	24	0.228	0.046
	16	0.2878	1.496	1.469	17.315	8.127	24	0.269	+0.008
	17	0.2906	1.455	1.516	17.190	8.453	24	0.270	-0.033
	18	0.2933	1.396	1.560	17.060	8.777	24	0.227	0.070
	19	+0.2960	-1.322	+1.593	+16.925	+9.099	-24	-0.147	-0.095
	20	0.2988	1.239	1.608	16.785	9.419	24	-0.045	0.103
	21	0.3015	1.153	1.603	16.640	9.736	24	+0.061	0.091
	22	0.3042	1.076	1.579	16.489	10.052	24	0.146	0.058
	23	0.3070	1.014	1.540	16.333	10.365	24	0.190	-0.011
	24	0.3097	0.973	1.498	16.172	10.676	24	0.180	+0.040
	25	+0.3125	-0.953	+1.466	+16.005	+10.984	-24	+0.117	+0.082
	26	0.3152	0.946	1.454	15.833	11.289	24	+0.019	0.103
	27	0.3179	0.941	1.469	15.656	11.591	24	-0.086	0.098
	28	0.3207	0.925	1.510	15.473	11.890	24	0.164	0.068
	29	0.3234	0.888	1.566	15.285	12.185	24	0.192	+0.022
	30	0.3261	0.828	1.626	15.091	12.476	24	0.163	-0.027
	31	+0.3289	-0.749	+1.676	+14.893	+12.763	-24	-0.087	-0.066
Nov.	1	0.3316	0.659	1.708	14.690	13.046	24	+0.013	0.087
	2	0.3344	0.568	1.720	14.483	13.325	24	0.115	0.087
	3	0.3371	0.484	1.714	14.271	13.599	24	0.198	0.070
	4	0.3398	0.412	1.696	14.055	13.870	24	0.249	0.040
	5	0.3426	0.355	1.671	13.835	14.136	24	0.261	-0.004
	6	+0.3453	-0.313	+1.646	+13.611	+14.397	-24	+0.233	+0.033
	7	0.3480	0.285	1.627	13.382	14.655	24	0.170	0.064
	8	0.3508	0.265	1.618	13.150	14.908	24	+0.082	0.084
	9	0.3535	0.251	1.624	12.914	15.157	24	-0.020	0.091
	10	0.3563	0.235	1.646	12.674	15.401	24	0.120	0.081
	11	0.3590	0.212	1.682	12.431	15.641	24	0.204	0.057
	12	+0.3617	-0.176	+1.730	+12.183	+15.876	-24	-0.256	+0.020
	13	0.3645	0.123	1.783	11.933	16.107	24	0.267	-0.021
	14	0.3672	-0.051	1.834	11.678	16.334	24	0.233	0.061
	15	0.3700	+0.038	1.875	11.420	16.556	24	0.159	0.091
	16	+0.3727	+0.138	+1.899	+11.159	+16.773	-24	-0.058	-0.103

BESSELIAN DAY NUMBERS, 2019.5
FOR 0^h TERRESTRIAL TIME

Date		τ	A	B	C	D	E	dψ	dε
			"	"	"	"	s (0.0001)		
Nov.	16	+0.3727	+0.138	+1.899	+11.159	+16.773	-24	-0.058	-0.103
	17	0.3754	0.241	1.902	10.894	16.987	24	+0.049	0.095
	18	0.3782	0.338	1.884	10.625	17.195	24	0.140	0.067
	19	0.3809	0.420	1.851	10.352	17.399	24	0.192	-0.023
	20	0.3836	0.483	1.812	10.076	17.598	24	0.194	+0.026
	21	0.3864	0.525	1.778	9.796	17.792	24	0.143	0.071
	22	+0.3891	+0.553	+1.760	+9.513	+17.981	-24	+0.052	+0.098
	23	0.3919	0.574	1.765	9.226	18.164	24	-0.054	0.102
	24	0.3946	0.602	1.795	8.936	18.342	24	0.146	0.080
	25	0.3973	0.647	1.844	8.642	18.514	24	0.198	+0.040
	26	0.4001	0.714	1.901	8.345	18.680	24	0.195	-0.008
	27	0.4028	0.803	1.953	8.045	18.840	24	0.138	0.053
	28	+0.4055	+0.907	+1.990	+7.742	+18.994	-24	-0.044	-0.083
	29	0.4083	1.017	2.006	7.437	19.142	24	+0.063	0.092
	30	0.4110	1.124	2.002	7.129	19.283	23	0.160	0.082
Dec.	1	0.4138	1.219	1.981	6.819	19.418	23	0.229	0.055
	2	0.4165	1.300	1.950	6.507	19.547	23	0.258	-0.019
	3	0.4192	1.364	1.916	6.194	19.670	23	0.245	+0.020
	4	+0.4220	+1.413	+1.886	+5.878	+19.786	-23	+0.194	+0.054
	5	0.4247	1.451	1.864	5.561	19.896	23	0.113	0.079
	6	0.4274	1.482	1.855	5.243	20.000	23	+0.014	0.091
	7	0.4302	1.512	1.862	4.923	20.098	23	-0.089	0.087
	8	0.4329	1.547	1.883	4.601	20.190	23	0.180	0.067
	9	0.4357	1.593	1.917	4.279	20.276	23	0.245	+0.034
	10	+0.4384	+1.655	+1.958	+3.955	+20.356	-23	-0.271	-0.007
	11	0.4411	1.735	2.000	3.630	20.430	23	0.250	0.049
	12	0.4439	1.834	2.034	3.304	20.497	23	0.185	0.084
	13	0.4466	1.946	2.051	2.977	20.559	23	-0.085	0.103
	14	0.4493	2.065	2.047	2.649	20.615	23	+0.029	0.101
	15	0.4521	2.179	2.020	2.320	20.666	23	0.132	0.077
	16	+0.4548	+2.279	+1.974	+1.990	+20.710	-22	+0.199	-0.035
	17	0.4576	2.358	1.919	1.659	20.748	22	0.214	+0.015
	18	0.4603	2.416	1.867	1.327	20.780	22	0.174	0.062
	19	0.4630	2.456	1.829	0.994	20.806	22	+0.091	0.094
	20	0.4658	2.488	1.813	0.660	20.826	22	-0.015	0.103
	21	0.4685	2.523	1.820	+0.326	20.838	23	0.113	0.089
	22	+0.4713	+2.570	+1.847	-0.010	+20.845	-23	-0.180	+0.054
	23	0.4740	2.637	1.884	0.345	20.844	23	0.198	+0.008
	24	0.4767	2.725	1.920	0.681	20.837	22	0.163	-0.038
	25	0.4795	2.830	1.945	1.017	20.822	22	-0.086	0.074
	26	0.4822	2.944	1.952	1.352	20.801	22	+0.016	0.091
	27	0.4849	3.058	1.937	1.688	20.773	22	0.118	0.089
	28	+0.4877	+3.164	+1.903	-2.022	+20.737	-22	+0.200	-0.068
	29	0.4904	3.256	1.857	2.356	20.695	22	0.246	-0.034
	30	0.4932	3.331	1.804	2.689	20.647	21	0.249	+0.005
	31	0.4959	3.389	1.752	3.020	20.591	21	0.212	0.042
	32	+0.4986	+3.434	+1.707	-3.351	+20.530	-22	+0.140	+0.071

SECOND-ORDER DAY NUMBERS, 2019
J FOR NORTHERN DECLINATIONS
FOR 0^h TT AND EQUINOX J 2019.5

Date		RIGHT ASCENSION												
		0^h 12^h	1^h 13^h	2^h 14^h	3^h 15^h	4^h 16^h	5^h 17^h	6^h 18^h	7^h 19^h	8^h 20^h	9^h 21^h	10^h 22^h	11^h 23^h	12^h 24^h
Jan.	-3	0	0	0	0	-1	-1	-1	-1	-1	-1	0	0	0
	7	-1	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1
	17	-1	-1	-1	-1	0	0	0	0	0	0	-1	-1	-1
	27	-1	-1	-1	-1	-1	0	0	0	0	0	0	-1	-1
Feb.	6	-1	-1	-2	-2	-2	-1	0	0	+1	+1	+1	0	-1
	16	0	-1	-2	-3	-3	-2	-1	0	+1	+2	+2	+1	0
	26	+2	0	-2	-3	-4	-4	-3	-1	+1	+2	+3	+3	+2
Mar.	8	+3	+1	-1	-3	-5	-5	-4	-2	+0	+2	+4	+4	+3
	18	+5	+3	0	-3	-5	-6	-6	-4	-1	+2	+4	+5	+5
	28	+7	+5	+2	-1	-5	-7	-8	-6	-3	0	+4	+6	+7
Apr.	7	+8	+7	+5	+1	-4	-7	-9	-8	-6	-2	+3	+6	+8
	17	+8	+9	+7	+3	-2	-7	-9	-10	-8	-4	+1	+6	+8
	27	+8	+10	+9	+5	0	-5	-9	-11	-10	-6	-1	+4	+8
May	7	+7	+10	+11	+8	+3	-3	-8	-11	-12	-9	-4	+2	+7
	17	+6	+10	+11	+10	+5	-1	-7	-11	-12	-11	-6	0	+6
	27	+3	+9	+11	+11	+8	+2	-4	-10	-12	-12	-9	-3	+3
June	6	+1	+7	+11	+12	+10	+5	-2	-8	-12	-13	-11	-6	+1
	16	-2	+4	+9	+12	+11	+7	+1	-5	-10	-13	-12	-8	-2
	26	-4	+2	+7	+11	+11	+9	+3	-3	-8	-12	-12	-10	-4
July	6	-7	-1	+5	+9	+11	+10	+6	0	-6	-10	-12	-11	-7
	16	-9	-4	+2	+7	+10	+10	+8	+3	-3	-8	-11	-11	-9
	26	-10	-6	-1	+5	+8	+10	+9	+5	0	-6	-9	-11	-10
Aug.	5	-10	-7	-3	+2	+6	+9	+9	+6	+2	-3	-7	-10	-10
	15	-9	-8	-5	-1	+3	+7	+8	+7	+4	0	-4	-8	-9
	25	-8	-9	-7	-3	+1	+5	+7	+8	+6	+2	-2	-6	-8
Sept.	4	-6	-8	-8	-5	-2	+2	+5	+7	+7	+4	+1	-3	-6
	14	-4	-7	-7	-6	-4	0	+3	+6	+6	+5	+3	-1	-4
	24	-2	-5	-7	-7	-6	-3	+1	+4	+6	+6	+5	+2	-2
Oct.	4	+1	-2	-5	-7	-7	-5	-2	+1	+4	+6	+6	+4	+1
	14	+3	0	-3	-6	-7	-6	-4	-1	+2	+5	+6	+5	+3
	24	+5	+3	-1	-4	-6	-7	-6	-4	0	+3	+5	+6	+5
Nov.	3	+6	+5	+2	-2	-5	-7	-7	-6	-3	+1	+4	+6	+6
	13	+7	+6	+4	+1	-3	-6	-8	-7	-5	-2	+2	+5	+7
	23	+6	+7	+6	+3	-1	-4	-7	-8	-7	-4	0	+3	+6
Dec.	3	+5	+7	+8	+6	+2	-2	-6	-8	-9	-7	-3	+1	+5
	13	+3	+7	+8	+7	+4	0	-4	-8	-9	-8	-5	-1	+3
	23	+1	+5	+8	+8	+7	+3	-2	-6	-9	-9	-8	-4	+1
	33	-2	+3	+7	+9	+8	+5	+1	-4	-8	-10	-9	-6	-2

The second-order day number J given in this table in units of $0^s.00001$

The apparent right ascension of a star is given by:

$\alpha = \alpha_1 + \tau\mu_\alpha/100 + Aa + Bb + Cc + Dd + E + J\tan^2\delta_1$

Where the position (α_1, δ_1) and centennial proper motion in right ascension (μ_α) are referred to the mean equator and equinox of J 2019.5

SECOND-ORDER DAY NUMBERS, 2019
J' FOR NORTHERN DECLINATIONS
FOR 0^h TT AND EQUINOX J 2019.5

Date		RIGHT ASCENSION												
		0^h 12^h	1^h 13^h	2^h 14^h	3^h 15^h	4^h 16^h	5^h 17^h	6^h 18^h	7^h 19^h	8^h 20^h	9^h 21^h	10^h 22^h	11^h 23^h	12^h 24^h
Jan.	-3	0	0	-1	-1	-1	-1	-1	0	0	0	0	0	0
	7	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	0	0
	17	-1	-1	0	0	0	0	-1	-1	-1	-1	-1	-1	0
	27	-2	-1	-1	-1	-1	-1	-1	-1	-1	-2	-2	-2	-2
Feb.	6	-3	-3	-2	-2	-1	-1	-1	-1	-1	-2	-2	-3	-3
	16	-4	-4	-4	-3	-2	-1	-1	-1	-1	-2	-3	-4	-4
	26	-5	-6	-6	-5	-3	-2	-1	-1	-1	-2	-3	-4	-5
Mar.	8	-6	-7	-8	-7	-5	-4	-2	-1	-1	-1	-3	-5	-6
	18	-7	-8	-9	-9	-8	-6	-3	-1	-1	-1	-2	-4	-7
	28	-6	-9	-11	-11	-10	-8	-5	-3	-1	-1	-2	-4	-6
Apr.	7	-6	-9	-12	-13	-13	-11	-8	-4	-2	-1	-1	-3	-6
	17	-5	-9	-12	-14	-15	-13	-10	-6	-3	-1	-1	-2	-5
	27	-4	-8	-12	-15	-16	-15	-13	-9	-5	-2	-1	-1	-4
May	7	-3	-7	-11	-15	-17	-17	-15	-11	-7	-3	-1	-1	-3
	17	-2	-5	-10	-14	-17	-18	-17	-14	-9	-5	-2	-1	-2
	27	-1	-4	-8	-13	-17	-19	-18	-16	-11	-7	-3	-1	-1
June	6	-1	-2	-6	-11	-15	-18	-19	-17	-14	-9	-4	-1	-1
	16	-1	-1	-4	-9	-13	-17	-19	-18	-15	-11	-6	-2	-1
	26	-1	-1	-3	-7	-11	-15	-18	-18	-16	-13	-8	-4	-1
July	6	-2	-1	-1	-4	-9	-13	-16	-18	-17	-14	-10	-5	-2
	16	-3	-1	-1	-3	-6	-11	-14	-17	-17	-15	-11	-7	-3
	26	-5	-2	-1	-1	-4	-8	-12	-15	-16	-15	-12	-8	-5
Aug.	5	-6	-3	-1	-1	-2	-6	-9	-13	-15	-15	-13	-10	-6
	15	-7	-4	-2	-1	-1	-3	-7	-10	-13	-14	-13	-11	-7
	25	-9	-6	-3	-1	-1	-2	-5	-8	-11	-12	-13	-11	-9
Sept.	4	-10	-7	-4	-2	-1	-1	-3	-5	-8	-11	-12	-11	-10
	14	-10	-8	-6	-3	-1	-1	-1	-3	-6	-8	-10	-11	-10
	24	-10	-9	-7	-5	-2	-1	-1	-2	-4	-6	-9	-10	-10
Oct.	4	-10	-10	-9	-6	-4	-2	-1	-1	-2	-4	-7	-9	-10
	14	-9	-10	-10	-8	-6	-3	-1	-1	-1	-3	-5	-7	-9
	24	-8	-10	-10	-10	-8	-5	-3	-1	-1	-1	-3	-6	-8
Nov.	3	-7	-9	-11	-11	-10	-7	-5	-2	-1	-1	-2	-4	-7
	13	-5	-8	-10	-11	-11	-9	-7	-4	-2	-1	-1	-3	-5
	23	-3	-6	-9	-11	-12	-11	-9	-6	-3	-1	-1	-1	-3
Dec.	3	-2	-5	-8	-11	-13	-13	-11	-9	-5	-3	-1	-1	-2
	13	-1	-3	-6	-10	-12	-13	-13	-11	-7	-4	-2	-1	-1
	23	-1	-2	-5	-8	-11	-13	-14	-13	-10	-6	-3	-1	-1
	33	-1	-1	-3	-6	-10	-13	-14	-14	-12	-9	-5	-2	-1

The second-order day number J' given in this table in units of 0".0001

The apparent declination of a star is given by:
$\delta = \delta_1 + \tau\mu_\delta/100 + Aa' + Bb' + Cc' + J' \tan\delta_1$

Where the declination (δ_1) and centennial proper motion in declination (μ_δ) are referred to the mean equator and equinox of J 2019.5

SECOND-ORDER DAY NUMBERS, 2019
J FOR SOUTHERN DECLINATIONS
FOR 0^h TT AND EQUINOX J 2019.5

Date		RIGHT ASCENSION												
		0^h 12^h	1^h 13^h	2^h 14^h	3^h 15^h	4^h 16^h	5^h 17^h	6^h 18^h	7^h 19^h	8^h 20^h	9^h 21^h	10^h 22^h	11^h 23^h	12^h 24^h
Jan.	-3	-9	+3	+14	+21	+22	+17	+8	-4	-15	-22	-23	-18	-9
	7	-12	-1	+10	+18	+22	+19	+11	0	-11	-19	-23	-20	-12
	17	-15	-5	+6	+15	+20	+20	+14	+4	-7	-16	-21	-21	-15
	27	-16	-8	+2	+11	+17	+19	+15	+7	-3	-12	-18	-20	-16
Feb.	6	-16	-11	-2	+7	+14	+17	+15	+10	+1	-8	-15	-18	-16
	16	-16	-12	-5	+3	+11	+15	+15	+11	+4	-4	-12	-16	-16
	26	-15	-13	-7	0	+7	+12	+14	+12	+6	-1	-8	-13	-15
Mar.	8	-13	-12	-9	-3	+3	+9	+12	+11	+8	+2	-4	-10	-13
	18	-10	-11	-9	-5	0	+5	+9	+10	+8	+4	-1	-6	-10
	28	-7	-9	-9	-7	-2	+2	+6	+8	+8	+6	+1	-3	-7
Apr.	7	-4	-7	-8	-7	-4	0	+3	+6	+7	+6	+3	-1	-4
	17	-2	-5	-7	-7	-5	-2	+1	+4	+6	+6	+4	+1	-2
	27	0	-3	-5	-6	-6	-4	-1	+2	+4	+5	+5	+3	0
May	7	+2	-1	-3	-5	-5	-5	-3	0	+2	+4	+4	+4	+2
	17	+3	+1	-1	-3	-4	-4	-4	-2	0	+2	+3	+3	+3
	27	+3	+2	+1	-1	-3	-4	-4	-3	-2	0	+2	+3	+3
June	6	+3	+3	+2	0	-1	-3	-4	-4	-3	-1	0	+2	+3
	16	+2	+2	+2	+2	0	-1	-3	-3	-3	-3	-1	0	+2
	26	0	+2	+2	+2	+1	0	-1	-3	-3	-3	-2	-1	0
July	6	-1	+1	+2	+2	+2	+1	0	-2	-3	-3	-3	-2	-1
	16	-2	-1	+1	+2	+3	+2	+1	0	-2	-3	-4	-3	-2
	26	-3	-2	-1	+1	+2	+3	+2	+1	0	-2	-3	-4	-3
Aug.	5	-4	-3	-2	0	+1	+3	+3	+2	+1	-1	-2	-4	-4
	15	-4	-4	-3	-2	0	+2	+3	+3	+2	+1	-1	-3	-4
	25	-3	-4	-4	-3	-1	+1	+2	+3	+3	+2	0	-2	-3
Sept.	4	-2	-4	-5	-4	-3	-1	+1	+3	+4	+3	+2	0	-2
	14	-1	-3	-5	-5	-4	-3	0	+2	+4	+4	+3	+2	-1
	24	+1	-1	-4	-5	-5	-4	-2	0	+3	+4	+4	+3	+1
Oct.	4	+3	0	-2	-5	-6	-5	-4	-1	+1	+4	+5	+4	+3
	14	+4	+2	-1	-3	-5	-6	-5	-3	0	+2	+4	+5	+4
	24	+5	+4	+1	-2	-4	-6	-6	-5	-2	+1	+3	+5	+5
Nov.	3	+5	+5	+3	0	-3	-5	-6	-6	-4	-1	+2	+4	+5
	13	+5	+5	+4	+2	-1	-4	-6	-6	-5	-3	0	+3	+5
	23	+4	+5	+5	+4	+1	-2	-5	-6	-6	-5	-2	+1	+4
Dec.	3	+2	+4	+5	+5	+3	0	-3	-5	-6	-6	-4	-1	+2
	13	0	+3	+5	+5	+4	+2	-1	-4	-6	-6	-5	-3	0
	23	-2	+1	+3	+5	+5	+3	+1	-2	-4	-6	-6	-4	-2
	33	-3	-1	+2	+4	+5	+4	+2	0	-3	-5	-6	-5	-3

The second-order day number J given in this table in units of $0^s.00001$

The apparent right ascension of a star is given by:
$\alpha = \alpha_1 + \tau\mu_\alpha/100 + Aa + Bb + Cc + Dd + E + J\ \tan^2\delta_1$

Where the position (α_1, δ_1) and centennial proper motion in right ascension (μ_α) are referred to the mean equator and equinox of J 2019.5

SECOND-ORDER DAY NUMBERS, 2019
J' FOR SOUTHERN DECLINATIONS
FOR 0^h TT AND EQUINOX J 2019.5

Date		RIGHT ASCENSION												
		0^h 12^h	1^h 13^h	2^h 14^h	3^h 15^h	4^h 16^h	5^h 17^h	6^h 18^h	7^h 19^h	8^h 20^h	9^h 21^h	10^h 22^h	11^h 23^h	12^h 24^h
Jan.	-3	-2	-1	-4	-11	-20	-28	-34	-34	-31	-24	-15	-7	-2
	7	-3	-1	-2	-8	-17	-25	-31	-34	-32	-26	-18	-9	-3
	17	-5	-1	-1	-6	-13	-21	-28	-32	-31	-27	-20	-11	-5
	27	-6	-2	-1	-3	-9	-17	-24	-29	-30	-27	-21	-13	-6
Feb.	6	-8	-3	-1	-2	-6	-13	-20	-25	-27	-26	-21	-15	-8
	16	-10	-4	-1	-1	-4	-9	-15	-21	-24	-24	-21	-16	-10
	26	-11	-6	-2	-1	-2	-6	-11	-17	-21	-22	-20	-16	-11
Mar.	8	-12	-7	-3	-1	-1	-4	-8	-13	-17	-19	-19	-16	-12
	18	-12	-8	-4	-1	-1	-2	-5	-9	-13	-16	-16	-15	-12
	28	-12	-9	-5	-2	-1	-1	-3	-6	-9	-12	-14	-14	-12
Apr.	7	-11	-9	-6	-3	-1	-1	-1	-3	-6	-9	-11	-12	-11
	17	-10	-9	-7	-4	-2	-1	-1	-2	-4	-6	-9	-10	-10
	27	-9	-8	-7	-5	-3	-1	-1	-1	-2	-4	-6	-8	-9
May	7	-7	-7	-7	-6	-4	-2	-1	-1	-1	-2	-4	-6	-7
	17	-5	-6	-6	-6	-5	-3	-2	-1	-1	-1	-2	-4	-5
	27	-4	-5	-6	-6	-5	-4	-3	-1	-1	-1	-1	-2	-4
June	6	-2	-3	-5	-5	-5	-5	-4	-2	-1	-1	-1	-1	-2
	16	-1	-2	-3	-4	-5	-5	-4	-3	-2	-1	-1	-1	-1
	26	-1	-1	-2	-3	-4	-5	-5	-4	-3	-2	-1	-1	-1
July	6	-1	-1	-1	-2	-3	-4	-5	-5	-4	-3	-2	-1	-1
	16	-1	-1	-1	-1	-3	-4	-5	-5	-5	-4	-3	-2	-1
	26	-2	-1	-1	-1	-2	-3	-4	-5	-5	-5	-4	-3	-2
Aug.	5	-3	-2	-1	-1	-1	-2	-3	-4	-5	-6	-5	-4	-3
	15	-4	-3	-2	-1	-1	-1	-2	-4	-5	-6	-6	-5	-4
	25	-6	-4	-3	-1	-1	-1	-1	-3	-4	-6	-6	-6	-6
Sept.	4	-7	-6	-4	-2	-1	-1	-1	-2	-3	-5	-6	-7	-7
	14	-7	-7	-6	-4	-2	-1	-1	-1	-2	-4	-6	-7	-7
	24	-8	-8	-7	-5	-3	-2	-1	-1	-1	-3	-5	-7	-8
Oct.	4	-7	-8	-8	-7	-5	-3	-1	-1	-1	-2	-4	-6	-7
	14	-7	-8	-9	-8	-7	-5	-2	-1	-1	-1	-3	-5	-7
	24	-6	-8	-9	-9	-8	-6	-4	-2	-1	-1	-2	-4	-6
Nov.	3	-4	-7	-8	-9	-9	-7	-5	-3	-1	-1	-1	-2	-4
	13	-3	-5	-7	-9	-9	-9	-7	-5	-2	-1	-1	-1	-3
	23	-2	-4	-6	-8	-9	-9	-8	-6	-4	-2	-1	-1	-2
Dec.	3	-1	-2	-5	-7	-8	-9	-9	-7	-5	-3	-1	-1	-1
	13	-1	-1	-3	-5	-7	-9	-9	-8	-6	-4	-2	-1	-1
	23	-1	-1	-2	-4	-6	-8	-9	-8	-7	-6	-3	-2	-1
	33	-1	-1	-1	-2	-4	-6	-7	-8	-8	-7	-5	-3	-1

The second-order day number J' given in this table in units of 0".0001

The apparent declination of a star is given by:
$\delta = \delta_1 + \tau\mu_\delta/100 + Aa' + Bb' + Cc' + J' \tan\delta_1$

Where the declination (δ_1) and centennial proper motion in declination (μ_δ) are referred to the mean equator and equinox of J 2019.5

POSITION AND VELOCITY OF THE EARTH, 2019
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Jan.	0	-0.154 250 56	+0.897 976 05	+0.389 206 80	-1728 5075	-251 6356	-109 0569
	1	0.171 511 54	0.895 320 70	0.388 056 06	1723 5952	279 4242	121 0869
	2	0.188 720 59	0.892 387 78	0.386 785 15	1718 1196	307 1491	133 0906
	3	0.205 872 05	0.889 177 98	0.385 394 36	1712 0787	334 7947	145 0618
	4	0.222 960 27	0.885 692 20	0.383 884 05	1705 4726	362 3451	156 9942
	5	0.239 979 62	0.881 931 45	0.382 254 63	1698 3030	389 7848	168 8814
	6	-0.256 924 47	+0.877 896 92	+0.380 506 59	-1690 5729	-417 0987	-180 7172
	7	0.273 789 23	0.873 589 95	0.378 640 48	1682 2870	444 2720	192 4952
	8	0.290 568 37	0.869 012 00	0.376 656 90	1673 4508	471 2912	204 2096
	9	0.307 256 43	0.864 164 68	0.374 556 52	1664 0710	498 1431	215 8544
	10	0.323 848 00	0.859 049 73	0.372 340 06	1654 1550	524 8156	227 4244
	11	0.340 337 77	0.853 669 00	0.370 008 30	1643 7106	551 2972	238 9141
	12	-0.356 720 48	+0.848 024 46	+0.367 562 06	-1632 7461	-577 5771	-250 3185
	13	0.372 990 99	0.842 118 17	0.365 002 23	1621 2708	603 6450	261 6330
	14	0.389 144 23	0.835 952 30	0.362 329 72	1609 2943	629 4915	272 8529
	15	0.405 175 24	0.829 529 11	0.359 545 50	1596 8272	655 1079	283 9736
	16	0.421 079 17	0.822 850 93	0.356 650 59	1583 8812	680 4863	294 9914
	17	0.436 851 31	0.815 920 19	0.353 646 03	1570 4688	705 6211	305 9028
	18	-0.452 487 04	+0.808 739 34	+0.350 532 89	-1556 6032	-730 5086	-316 7052
	19	0.467 981 90	0.801 310 85	0.347 312 29	1542 2971	755 1483	327 3973
	20	0.483 331 55	0.793 637 19	0.343 985 31	1527 5613	779 5428	337 9794
	21	0.498 531 72	0.785 720 79	0.340 553 06	1512 4031	803 6972	348 4526
	22	0.513 578 21	0.777 564 03	0.337 016 62	1496 8246	827 6171	358 8190
	23	0.528 466 80	0.769 169 22	0.333 377 03	1480 8228	851 3064	369 0806
	24	-0.543 193 24	+0.760 538 67	+0.329 635 35	-1464 3912	-874 7653	-379 2382
	25	0.557 753 17	0.751 674 69	0.325 792 62	1447 5213	897 9897	389 2910
	26	0.572 142 18	0.742 579 68	0.321 849 89	1430 2057	920 9705	399 2363
	27	0.586 355 78	0.733 256 13	0.317 808 26	1412 4393	943 6956	409 0702
	28	0.600 389 45	0.723 706 67	0.313 668 87	1394 2200	966 1514	418 7879
	29	0.614 238 67	0.713 934 05	0.309 432 91	1375 5484	988 3234	428 3838
	30	-0.627 898 92	+0.703 941 19	+0.305 101 62	-1356 4273	-1010 1974	-437 8524
	31	0.641 365 73	0.693 731 14	0.300 676 31	1336 8618	1031 7597	447 1883
Feb.	1	0.654 634 70	0.683 307 08	0.296 158 32	1316 8581	1052 9970	456 3862
	2	0.667 701 46	0.672 672 33	0.291 549 06	1296 4239	1073 8967	465 4407
	3	0.680 561 77	0.661 830 31	0.286 850 00	1275 5677	1094 4471	474 3468
	4	0.693 211 44	0.650 784 59	0.282 062 63	1254 2989	1114 6367	483 0998
	5	-0.705 646 41	+0.639 538 82	+0.277 188 53	-1232 6284	-1134 4548	-491 6948
	6	0.717 862 70	0.628 096 76	0.272 229 28	1210 5670	1153 8919	500 1274
	7	0.729 856 48	0.616 462 28	0.267 186 54	1188 1268	1172 9388	508 3934
	8	0.741 624 02	0.604 639 31	0.262 061 98	1165 3208	1191 5874	516 4892
	9	0.753 161 72	0.592 631 88	0.256 857 33	1142 1616	1209 8306	524 4110
	10	0.764 466 12	0.580 444 07	0.251 574 35	1118 6630	1227 6621	532 1556
	11	-0.775 533 90	+0.568 080 03	+0.246 214 82	-1094 8391	-1245 0766	-539 7202
	12	0.786 361 87	0.555 543 95	0.240 780 55	1070 7046	1262 0695	547 1026
	13	0.796 947 00	0.542 840 06	0.235 273 38	1046 2741	1278 6383	554 3003
	14	0.807 286 42	0.529 972 60	0.229 695 17	1021 5633	1294 7815	561 3120
	15	-0.817 377 39	+0.516 945 84	+0.224 047 76	-996 5878	-1310 4999	-568 1376

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2019
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Jan.	0	-1039	-418 092	-181 658	+418 096	-874	+1901	+181 648	-2660	-165
	1	1039	418 150	181 683	418 154	874	1911	181 673	2670	165
	2	1040	418 226	181 716	418 230	875	1922	181 706	2682	165
	3	1040	418 317	181 756	418 322	875	1932	181 746	2692	165
	4	1041	418 422	181 801	418 426	875	1937	181 791	2698	165
	5	1041	418 533	181 849	418 537	876	1934	181 839	2695	165
	6	-1042	-418 643	-181 897	+418 647	-876	+1924	+181 887	-2686	-165
	7	1042	418 747	181 942	418 751	877	1907	181 932	2669	166
	8	1043	418 839	181 982	418 843	877	1884	181 973	2646	166
	9	1043	418 917	182 016	418 921	877	1858	182 006	2621	166
	10	1043	418 978	182 042	418 982	878	1832	182 033	2595	166
	11	1044	419 026	182 063	419 030	878	1808	182 054	2571	166
	12	-1044	-419 062	-182 079	+419 066	-878	+1789	+182 070	-2552	-166
	13	1044	419 094	182 093	419 097	878	1776	182 084	2539	166
	14	1044	419 126	182 107	419 130	878	1770	182 098	2533	166
	15	1044	419 166	182 124	419 170	879	1772	182 115	2535	166
	16	1045	419 222	182 149	419 226	879	1778	182 139	2542	166
	17	1045	419 299	182 182	419 303	879	1787	182 173	2551	166
	18	-1046	-419 400	-182 226	+419 404	-880	+1794	+182 216	-2558	-166
	19	1046	419 520	182 278	419 524	880	1793	182 269	2558	166
	20	1047	419 650	182 334	419 654	881	1781	182 325	2546	166
	21	1047	419 776	182 389	419 780	881	1755	182 380	2521	166
	22	1048	419 882	182 435	419 886	882	1720	182 426	2486	166
	23	1048	419 959	182 469	419 963	882	1681	182 460	2447	166
	24	-1049	-420 008	-182 490	+420 012	-882	+1645	+182 481	-2412	-167
	25	1049	420 037	182 502	420 040	882	1619	182 494	2386	167
	26	1049	420 058	182 511	420 062	882	1604	182 503	2371	167
	27	1049	420 084	182 523	420 088	882	1600	182 515	2367	167
	28	1049	420 124	182 540	420 128	883	1603	182 532	2370	167
	29	1049	420 181	182 565	420 185	883	1609	182 557	2376	167
	30	-1050	-420 254	-182 597	+420 258	-883	+1614	+182 588	-2381	-167
	31	1050	420 341	182 634	420 344	883	1615	182 626	2382	167
Feb.	1	1051	420 434	182 675	420 437	884	1609	182 666	2377	167
	2	1051	420 528	182 716	420 532	884	1595	182 707	2364	167
	3	1052	420 617	182 754	420 620	885	1575	182 746	2344	167
	4	1052	420 694	182 788	420 698	885	1549	182 780	2318	167
	5	-1052	-420 758	-182 815	+420 761	-885	+1520	+182 807	-2289	-167
	6	1053	420 805	182 836	420 809	885	1490	182 828	2259	167
	7	1053	420 838	182 850	420 841	886	1462	182 842	2231	167
	8	1053	420 858	182 859	420 861	886	1438	182 851	2208	167
	9	1053	420 871	182 865	420 875	886	1421	182 857	2190	167
	10	1053	420 884	182 870	420 887	886	1411	182 863	2180	167
	11	-1053	-420 902	-182 878	+420 905	-886	+1408	+182 871	-2178	-167
	12	1053	420 932	182 891	420 936	886	1411	182 884	2181	167
	13	1053	420 981	182 913	420 984	886	1417	182 905	2187	167
	14	1054	421 051	182 943	421 054	886	1423	182 935	2194	167
	15	-1054	-421 141	-182 982	+421 144	-887	+1425	+182 974	-2195	-167

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2019
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Feb.	15	-0.817 377 39	+0.516 945 84	+0.224 047 76	-996 5878	-1310 4999	-568 1376
	16	0.827 217 34	0.503 764 01	0.218 333 04	971 3619	1325 7970	574 7773
	17	0.836 803 83	0.490 431 29	0.212 552 83	945 8985	1340 6788	581 2328
	18	0.846 134 55	0.476 951 79	0.206 708 98	920 2068	1355 1535	587 5071
	19	0.855 207 22	0.463 329 55	0.200 803 28	894 2912	1369 2296	593 6038
	20	0.864 019 62	0.449 568 50	0.194 837 49	868 1513	1382 9144	599 5262
	21	-0.872 569 48	+0.435 672 55	+0.188 813 33	-841 7822	-1396 2108	-605 2764
	22	0.880 854 48	0.421 645 58	0.182 732 53	815 1781	1409 1173	610 8550
	23	0.888 872 25	0.407 491 53	0.176 596 81	788 3338	1421 6274	616 2605
	24	0.896 620 35	0.393 214 39	0.170 407 91	761 2469	1433 7310	621 4901
	25	0.904 096 38	0.378 818 30	0.164 167 61	733 9188	1445 4168	626 5395
	26	0.911 297 94	0.364 307 49	0.157 877 73	706 3540	1456 6729	631 4047
	27	-0.918 222 69	+0.349 686 31	+0.151 540 14	-678 5597	-1467 4884	-636 0814
	28	0.924 868 40	0.334 959 22	0.145 156 75	650 5450	1477 8532	640 5656
Mar.	1	0.931 232 89	0.320 130 78	0.138 729 48	622 3201	1487 7585	644 8536
	2	0.937 314 14	0.305 205 61	0.132 260 34	593 8960	1497 1964	648 9420
	3	0.943 110 19	0.290 188 43	0.125 751 32	565 2846	1506 1598	652 8278
	4	0.948 619 24	0.275 084 02	0.119 204 47	536 4978	1514 6422	656 5081
	5	-0.953 839 60	+0.259 897 21	+0.112 621 85	-507 5486	-1522 6379	-659 9803
	6	0.958 769 72	0.244 632 90	0.106 005 57	478 4506	1530 1417	663 2418
	7	0.963 408 17	0.229 296 03	0.099 357 73	449 2178	1537 1494	666 2906
	8	0.967 753 67	0.213 891 58	0.092 680 47	419 8649	1543 6576	669 1246
	9	0.971 805 12	0.198 424 55	0.085 975 95	390 4072	1549 6639	671 7425
	10	0.975 561 52	0.182 899 98	0.079 246 34	360 8603	1555 1673	674 1433
	11	-0.979 022 08	+0.167 322 88	+0.072 493 81	-331 2399	-1560 1679	-676 3262
	12	0.982 186 13	0.151 698 29	0.065 720 54	301 5621	1564 6671	678 2913
	13	0.985 053 18	0.136 031 20	0.058 928 71	271 8426	1568 6679	680 0391
	14	0.987 622 89	0.120 326 58	0.052 120 48	242 0968	1572 1751	681 5708
	15	0.989 895 08	0.104 589 32	0.045 298 01	212 3393	1575 1949	682 8884
	16	0.991 869 69	0.088 824 28	0.038 463 42	182 5837	1577 7359	683 9948
	17	-0.993 546 79	+0.073 036 17	+0.031 618 80	-152 8406	-1579 8081	-684 8940
	18	0.994 926 57	0.057 229 64	0.024 766 21	123 1180	1581 4228	685 5905
	19	0.996 009 23	0.041 409 20	0.017 907 65	93 4195	1582 5915	686 0889
	20	0.996 795 03	0.025 579 26	0.011 045 08	63 7443	1583 3236	686 3942
	21	0.997 284 18	+0.009 744 16	+0.004 180 40	34 0885	1583 6251	686 5098
	22	0.997 476 85	-0.006 091 81	-0.002 684 49	-4 4466	1583 4977	686 4375
	23	-0.997 373 15	-0.021 924 35	-0.009 547 72	+25 1857	-1582 9379	-686 1774
	24	0.996 973 16	0.037 749 11	0.016 407 41	54 8102	1581 9396	685 7279
	25	0.996 276 98	0.053 561 65	0.023 261 64	84 4249	1580 4946	685 0866
	26	0.995 284 71	0.069 357 48	0.030 108 49	114 0244	1578 5945	684 2505
	27	0.993 996 57	0.085 132 00	0.036 945 99	143 6002	1576 2322	683 2169
	28	0.992 412 82	0.100 880 57	0.043 772 16	173 1423	1573 4019	681 9837
	29	-0.990 533 87	-0.116 598 47	-0.050 584 99	+202 6395	-1570 0991	-680 5487
	30	0.988 360 22	0.132 280 96	0.057 382 46	232 0801	1566 3203	678 9105
	31	0.985 892 50	0.147 923 28	0.064 162 52	261 4520	1562 0635	677 0681
Apr.	1	0.983 131 45	0.163 520 63	0.070 923 14	290 7431	1557 3269	675 0205
	2	-0.980 077 95	-0.179 068 21	-0.077 662 25	+319 9406	-1552 1093	-672 7670

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2019
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Feb.	15	-1054	-421 141	-182 982	+421 144	-887	+1425	+182 974	-2195	-167
	16	1055	421 245	183 027	421 248	887	1417	183 019	2188	168
	17	1055	421 351	183 073	421 355	888	1398	183 066	2169	168
	18	1056	421 447	183 115	421 450	888	1367	183 108	2139	168
	19	1056	421 519	183 146	421 522	888	1329	183 139	2101	168
	20	1056	421 561	183 165	421 564	889	1291	183 157	2063	168
	21	-1056	-421 578	-183 172	+421 581	-889	+1261	+183 165	-2033	-168
	22	1056	421 581	183 173	421 584	889	1242	183 166	2014	168
	23	1056	421 584	183 175	421 587	889	1236	183 168	2008	168
	24	1057	421 600	183 182	421 603	889	1239	183 175	2012	168
	25	1057	421 634	183 196	421 637	889	1248	183 189	2021	168
	26	1057	421 686	183 219	421 689	889	1257	183 212	2030	168
	27	-1057	-421 753	-183 248	+421 756	-889	+1263	+183 241	-2035	-168
	28	1058	421 828	183 281	421 831	890	1262	183 274	2035	168
Mar.	1	1058	421 906	183 314	421 909	890	1254	183 307	2027	168
	2	1058	421 979	183 346	421 982	890	1239	183 339	2013	168
	3	1059	422 043	183 374	422 045	891	1219	183 367	1993	168
	4	1059	422 093	183 396	422 096	891	1194	183 389	1968	168
	5	-1059	-422 127	-183 411	+422 130	-891	+1169	+183 404	-1943	-168
	6	1059	422 147	183 419	422 150	891	1145	183 413	1919	168
	7	1059	422 154	183 422	422 157	891	1125	183 416	1899	168
	8	1059	422 152	183 422	422 155	891	1112	183 415	1886	168
	9	1059	422 149	183 420	422 152	891	1106	183 414	1880	168
	10	1059	422 150	183 421	422 153	891	1107	183 415	1882	168
	11	-1059	-422 163	-183 427	+422 166	-891	+1116	+183 420	-1890	-168
	12	1059	422 193	183 440	422 196	891	1128	183 433	1902	168
	13	1060	422 243	183 461	422 246	891	1141	183 455	1915	168
	14	1060	422 312	183 491	422 315	892	1150	183 485	1925	168
	15	1061	422 396	183 528	422 399	892	1153	183 521	1928	168
	16	1061	422 487	183 567	422 490	893	1145	183 561	1920	168
	17	-1061	-422 573	-183 605	+422 576	-893	+1126	+183 598	-1902	-169
	18	1062	422 642	183 635	422 645	893	1100	183 629	1876	169
	19	1062	422 686	183 654	422 689	893	1070	183 648	1846	169
	20	1062	422 704	183 661	422 706	893	1043	183 655	1819	169
	21	1062	422 702	183 661	422 705	893	1027	183 655	1803	169
	22	1062	422 695	183 658	422 698	893	1023	183 652	1800	169
	23	-1062	-422 697	-183 659	+422 699	-893	+1032	+183 653	-1808	-169
	24	1062	422 716	183 667	422 719	893	1048	183 661	1825	169
	25	1062	422 757	183 685	422 760	894	1067	183 679	1844	169
	26	1063	422 816	183 711	422 819	894	1084	183 704	1860	169
	27	1063	422 888	183 742	422 890	894	1094	183 735	1871	169
	28	1063	422 964	183 775	422 966	895	1097	183 768	1874	169
	29	-1064	-423 037	-183 807	+423 040	-895	+1093	+183 800	-1870	-169
	30	1064	423 102	183 835	423 105	895	1082	183 829	1860	169
	31	1064	423 154	183 857	423 157	895	1067	183 851	1845	169
Apr.	1	1065	423 192	183 874	423 194	895	1050	183 868	1828	169
	2	-1065	-423 214	-183 884	+423 217	-896	+1034	+183 877	-1812	-169

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2019
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Apr.	1	-0.983 131 45	-0.163 520 63	-0.070 923 14	+290 7431	-1557 3269	-675 0205
	2	0.980 077 95	0.179 068 21	0.077 662 25	319 9406	1552 1093	672 7670
	3	0.976 732 99	0.194 561 21	0.084 377 79	349 0316	1546 4105	670 3071
	4	0.973 097 72	0.209 994 82	0.091 067 70	378 0022	1540 2304	667 6405
	5	0.969 173 40	0.225 364 22	0.097 729 91	406 8383	1533 5703	664 7673
	6	0.964 961 45	0.240 664 63	0.104 362 36	435 5253	1526 4324	661 6878
	7	-0.960 463 44	-0.255 891 29	-0.110 962 98	+464 0481	-1518 8204	-658 4030
	8	0.955 681 09	0.271 039 48	0.117 529 74	492 3913	1510 7394	654 9142
	9	0.950 616 26	0.286 104 54	0.124 060 60	520 5402	1502 1963	651 2240
	10	0.945 270 98	0.301 081 89	0.130 553 56	548 4810	1493 1996	647 3351
	11	0.939 647 38	0.315 967 05	0.137 006 65	576 2003	1483 7595	643 2512
	12	0.933 747 75	0.330 755 64	0.143 417 94	603 6872	1473 8878	638 9768
	13	-0.927 574 44	-0.345 443 41	-0.149 785 56	+630 9325	-1463 5969	-634 5167
	14	0.921 129 92	0.360 026 23	0.156 107 68	657 9296	1452 9003	629 8768
	15	0.914 416 69	0.374 500 11	0.162 382 52	684 6752	1441 8117	625 0627
	16	0.907 437 26	0.388 861 20	0.168 608 37	711 1693	1430 3436	620 0803
	17	0.900 194 13	0.403 105 75	0.174 783 58	737 4146	1418 5063	614 9347
	18	0.892 689 78	0.417 230 12	0.180 906 54	763 4165	1406 3072	609 6300
	19	-0.884 926 59	-0.431 230 70	-0.186 975 66	+789 1810	-1393 7494	-604 1690
	20	0.876 906 93	0.445 103 91	0.192 989 40	814 7127	1380 8324	598 5526
	21	0.868 633 11	0.458 846 14	0.198 946 19	840 0142	1367 5531	592 7805
	22	0.860 107 42	0.472 453 75	0.204 844 49	865 0846	1353 9064	586 8516
	23	0.851 332 20	0.485 923 03	0.210 682 70	889 9193	1339 8876	580 7642
	24	0.842 309 84	0.499 250 24	0.216 459 24	914 5115	1325 4925	574 5171
	25	-0.833 042 81	-0.512 431 62	-0.222 172 50	+938 8524	-1310 7187	-568 1090
	26	0.823 533 66	0.525 463 35	0.227 820 88	962 9322	1295 5650	561 5395
	27	0.813 785 07	0.538 341 65	0.233 402 75	986 7406	1280 0317	554 8086
	28	0.803 799 79	0.551 062 72	0.238 916 51	1010 2673	1264 1200	547 9165
	29	0.793 580 70	0.563 622 79	0.244 360 55	1033 5017	1247 8317	540 8637
	30	0.783 130 77	0.576 018 11	0.249 733 26	1056 4332	1231 1695	533 6512
May	1	-0.772 453 08	-0.588 244 95	-0.255 033 04	+1079 0510	-1214 1363	-526 2798
	2	0.761 550 83	0.600 299 61	0.260 258 33	1101 3436	1196 7356	518 7504
	3	0.750 427 33	0.612 178 45	0.265 407 53	1123 2991	1178 9718	511 0646
	4	0.739 086 01	0.623 877 86	0.270 479 10	1144 9050	1160 8505	503 2242
	5	0.727 530 44	0.635 394 29	0.275 471 51	1166 1481	1142 3786	495 2314
	6	0.715 764 30	0.646 724 29	0.280 383 23	1187 0158	1123 5653	487 0893
	7	-0.703 791 42	-0.657 864 49	-0.285 212 81	+1207 4958	-1104 4212	-478 8018
	8	0.691 615 72	0.668 811 65	0.289 958 80	1227 5770	1084 9593	470 3737
	9	0.679 241 24	0.679 562 67	0.294 619 83	1247 2508	1065 1939	461 8106
	10	0.666 672 08	0.690 114 57	0.299 194 58	1266 5106	1045 1404	453 1186
	11	0.653 912 41	0.700 464 57	0.303 681 80	1285 3533	1024 8145	444 3044
	12	0.640 966 41	0.710 610 00	0.308 080 29	1303 7783	1004 2313	435 3747
	13	-0.627 838 23	-0.720 548 38	-0.312 388 93	+1321 7880	-983 4048	-426 3356
	14	0.614 532 02	0.730 277 33	0.316 606 66	1339 3869	962 3471	417 1934
	15	0.601 051 84	0.739 794 59	0.320 732 47	1356 5816	941 0678	407 9528
	16	0.587 401 71	0.749 097 97	0.324 765 40	1373 3795	919 5731	398 6178
	17	-0.573 585 55	-0.758 185 34	-0.328 704 52	+1389 7875	-897 8665	-389 1910

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2019
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Apr.	1	-1065	-423 192	-183 874	+423 194	-895	+1050	+183 868	-1828	-169
	2	1065	423 214	183 884	423 217	896	1034	183 877	1812	169
	3	1065	423 223	183 888	423 226	896	1021	183 882	1800	169
	4	1065	423 224	183 888	423 226	896	1015	183 882	1793	169
	5	1065	423 221	183 886	423 223	896	1015	183 881	1794	169
	6	1065	423 221	183 887	423 224	896	1024	183 881	1802	169
	7	-1065	-423 233	-183 892	+423 235	-896	+1040	+183 886	-1818	-169
	8	1065	423 261	183 904	423 264	896	1060	183 898	1839	169
	9	1065	423 310	183 925	423 312	896	1082	183 919	1861	169
	10	1065	423 379	183 955	423 382	896	1101	183 949	1880	169
	11	1066	423 464	183 992	423 467	897	1114	183 986	1893	169
	12	1066	423 557	184 033	423 560	897	1117	184 027	1897	169
	13	-1067	-423 649	-184 073	+423 652	-897	+1110	+184 066	-1890	-169
	14	1067	423 727	184 107	423 730	898	1094	184 100	1874	169
	15	1067	423 784	184 131	423 787	898	1074	184 125	1854	170
	16	1068	423 817	184 145	423 819	898	1054	184 139	1834	170
	17	1068	423 829	184 151	423 831	898	1042	184 145	1822	170
	18	1068	423 831	184 152	423 833	898	1040	184 146	1821	170
	19	-1068	-423 836	-184 154	+423 838	-898	+1052	+184 148	-1832	-170
	20	1068	423 856	184 163	423 859	898	1073	184 157	1853	170
	21	1068	423 898	184 181	423 901	898	1099	184 175	1879	170
	22	1068	423 962	184 209	423 965	899	1124	184 203	1905	170
	23	1069	424 043	184 244	424 046	899	1144	184 238	1926	170
	24	1069	424 133	184 283	424 135	899	1157	184 276	1938	170
	25	-1070	-424 222	-184 322	+424 225	-900	+1161	+184 315	-1943	-170
	26	1070	424 305	184 358	424 308	900	1158	184 351	1940	170
	27	1070	424 376	184 389	424 379	900	1149	184 382	1932	170
	28	1071	424 432	184 413	424 435	901	1138	184 406	1920	170
	29	1071	424 473	184 431	424 476	901	1126	184 424	1909	170
	30	1071	424 500	184 442	424 502	901	1117	184 436	1900	170
May	1	-1071	-424 516	-184 450	+424 519	-901	+1113	+184 443	-1896	-170
	2	1071	424 528	184 455	424 530	901	1116	184 448	1899	170
	3	1071	424 541	184 461	424 544	901	1126	184 454	1909	170
	4	1071	424 564	184 470	424 566	901	1144	184 464	1928	170
	5	1072	424 602	184 487	424 605	901	1168	184 480	1951	170
	6	1072	424 662	184 513	424 665	902	1194	184 506	1978	170
	7	-1072	-424 743	-184 548	+424 746	-902	+1218	+184 541	-2002	-170
	8	1073	424 843	184 592	424 846	902	1236	184 585	2020	170
	9	1073	424 953	184 640	424 956	903	1244	184 633	2029	170
	10	1074	425 063	184 687	425 066	903	1242	184 680	2027	171
	11	1074	425 161	184 730	425 164	904	1230	184 723	2015	171
	12	1075	425 240	184 764	425 243	904	1212	184 757	1998	171
	13	-1075	-425 294	-184 788	+425 297	-904	+1194	+184 781	-1980	-171
	14	1075	425 328	184 802	425 331	905	1181	184 796	1967	171
	15	1075	425 349	184 811	425 351	905	1177	184 805	1963	171
	16	1075	425 368	184 820	425 371	905	1185	184 813	1971	171
	17	-1076	-425 399	-184 833	+425 402	-905	+1203	+184 826	-1990	-171

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2019
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
May	17	-0.573 585 55	-0.758 185 34	-0.328 704 52	+1389 7875	-897 8665	-389 1910
	18	0.559 607 24	0.767 054 59	0.332 548 92	1405 8115	875 9488	379 6736
	19	0.545 470 59	0.775 703 61	0.336 297 69	1421 4548	853 8182	370 0662
	20	0.531 179 41	0.784 130 24	0.339 949 94	1436 7180	831 4726	360 3683
	21	0.516 737 50	0.792 332 33	0.343 504 75	1451 5989	808 9093	350 5793
	22	0.502 148 72	0.800 307 70	0.346 961 22	1466 0930	786 1267	340 6986
	23	-0.487 416 95	-0.808 054 14	-0.350 318 42	+1480 1939	-763 1245	-330 7262
	24	0.472 546 17	0.815 569 46	0.353 575 44	1493 8945	739 9036	320 6622
	25	0.457 540 42	0.822 851 49	0.356 731 36	1507 1871	716 4663	310 5074
	26	0.442 403 82	0.829 898 07	0.359 785 29	1520 0640	692 8160	300 2631
	27	0.427 140 55	0.836 707 11	0.362 736 33	1532 5173	668 9567	289 9305
	28	0.411 754 91	0.843 276 53	0.365 583 61	1544 5393	644 8929	279 5112
	29	-0.396 251 23	-0.849 604 30	-0.368 326 27	+1556 1219	-620 6299	-269 0072
	30	0.380 633 96	0.855 688 48	0.370 963 47	1567 2569	596 1730	258 4201
	31	0.364 907 62	0.861 527 14	0.373 494 40	1577 9353	571 5287	247 7522
June	1	0.349 076 81	0.867 118 45	0.375 918 26	1588 1474	546 7043	237 0062
	2	0.333 146 26	0.872 460 66	0.378 234 27	1597 8834	521 7091	226 1850
	3	0.317 120 76	0.877 552 10	0.380 441 72	1607 1334	496 5538	215 2925
	4	-0.301 005 24	-0.882 391 24	-0.382 539 90	+1615 8880	-471 2520	-204 3338
	5	0.284 804 68	0.886 976 70	0.384 528 19	1624 1404	445 8193	193 3149
	6	0.268 524 12	0.891 307 25	0.386 406 02	1631 8861	420 2727	182 2424
	7	0.252 168 65	0.895 381 84	0.388 172 89	1639 1242	394 6298	171 1238
	8	0.235 743 32	0.899 199 58	0.389 828 37	1645 8576	368 9078	159 9666
	9	0.219 253 16	0.902 759 78	0.391 372 11	1652 0922	343 1217	148 7777
	10	-0.202 703 11	-0.906 061 85	-0.392 803 84	+1657 8362	-317 2847	-137 5636
	11	0.186 098 04	0.909 105 34	0.394 123 32	1663 0994	291 4067	126 3295
	12	0.169 442 69	0.911 889 87	0.395 330 38	1667 8917	265 4946	115 0793
	13	0.152 741 74	0.914 415 13	0.396 424 86	1672 2228	239 5529	103 8163
	14	0.135 999 75	0.916 680 83	0.397 406 67	1676 1009	213 5837	92 5424
	15	0.119 221 21	0.918 686 71	0.398 275 68	1679 5323	187 5874	81 2584
	16	-0.102 410 57	-0.920 432 49	-0.399 031 80	+1682 5219	-161 5633	-69 9649
	17	0.085 572 24	0.921 917 88	0.399 674 94	1685 0716	135 5101	58 6620
	18	0.068 710 61	0.923 142 59	0.400 205 01	1687 1812	109 4267	47 3494
	19	0.051 830 09	0.924 106 32	0.400 621 90	1688 8488	83 3129	36 0270
	20	0.034 935 12	0.924 808 75	0.400 925 52	1690 0710	57 1696	24 6953
	21	0.018 030 17	0.925 249 61	0.401 115 78	1690 8437	30 9986	13 3549
	22	-0.001 119 76	-0.925 428 64	-0.401 192 59	+1691 1620	-4 8032	-2 0066
	23	+0.015 791 54	0.925 345 61	0.401 155 89	1691 0213	+21 4124	+9 3479
	24	0.032 699 12	0.925 000 34	0.401 005 62	1690 4166	47 6435	20 7070
	25	0.049 598 31	0.924 392 71	0.400 741 74	1689 3430	73 8843	32 0687
	26	0.066 484 40	0.923 522 64	0.400 364 24	1687 7959	100 1290	43 4308
	27	0.083 352 63	0.922 390 14	0.399 873 13	1685 7698	126 3711	54 7912
	28	+0.100 198 18	-0.920 995 25	-0.399 268 43	+1683 2591	+152 6035	+66 1475
	29	0.117 016 18	0.919 338 13	0.398 550 20	1680 2575	178 8178	77 4966
	30	0.133 801 68	0.917 418 99	0.397 718 53	1676 7583	205 0044	88 8351
July	1	0.150 549 67	0.915 238 17	0.396 773 55	1672 7552	231 1512	100 1588
	2	+0.167 255 08	-0.912 796 15	-0.395 715 42	+1668 2420	+257 2438	+111 4624

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2019
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
May	17	-1076	-425 399	-184 833	+425 402	-905	+1203	+184 826	-1990	-171
	18	1076	425 449	184 855	425 452	905	1228	184 848	2015	171
	19	1076	425 521	184 886	425 524	905	1254	184 879	2041	171
	20	1077	425 613	184 926	425 617	906	1277	184 919	2064	171
	21	1077	425 718	184 972	425 722	906	1292	184 965	2079	171
	22	1078	425 827	185 019	425 831	907	1299	185 012	2086	171
	23	-1078	-425 932	-185 065	+425 935	-907	+1297	+185 057	-2085	-171
	24	1079	426 026	185 105	426 029	908	1288	185 098	2077	171
	25	1079	426 105	185 140	426 108	908	1275	185 132	2064	171
	26	1080	426 167	185 167	426 170	908	1261	185 160	2050	171
	27	1080	426 215	185 188	426 218	908	1248	185 181	2038	171
	28	1080	426 251	185 203	426 254	908	1240	185 196	2029	172
	29	-1080	-426 280	-185 216	+426 283	-909	+1237	+185 209	-2027	-172
	30	1080	426 307	185 228	426 310	909	1242	185 221	2031	172
	31	1080	426 341	185 242	426 344	909	1254	185 235	2044	172
June	1	1081	426 389	185 263	426 392	909	1273	185 256	2063	172
	2	1081	426 456	185 292	426 459	909	1295	185 285	2085	172
	3	1081	426 546	185 332	426 549	910	1316	185 324	2107	172
	4	-1082	-426 657	-185 380	+426 660	-910	+1333	+185 372	-2124	-172
	5	1083	426 783	185 434	426 786	911	1340	185 427	2132	172
	6	1083	426 911	185 490	426 914	911	1336	185 483	2128	172
	7	1084	427 030	185 541	427 033	912	1320	185 534	2113	172
	8	1084	427 128	185 584	427 131	912	1298	185 577	2090	172
	9	1085	427 202	185 616	427 205	913	1273	185 609	2066	172
	10	-1085	-427 252	-185 638	+427 255	-913	+1253	+185 631	-2046	-172
	11	1085	427 287	185 653	427 290	913	1241	185 646	2035	172
	12	1085	427 317	185 666	427 320	913	1241	185 659	2034	172
	13	1086	427 355	185 683	427 358	913	1250	185 676	2043	172
	14	1086	427 409	185 706	427 412	913	1267	185 699	2060	172
	15	1086	427 484	185 739	427 487	914	1286	185 732	2080	173
	16	-1087	-427 579	-185 780	+427 582	-914	+1303	+185 773	-2098	-173
	17	1087	427 689	185 828	427 692	915	1314	185 820	2109	173
	18	1088	427 806	185 878	427 809	915	1317	185 871	2112	173
	19	1088	427 921	185 928	427 924	916	1311	185 921	2107	173
	20	1089	428 027	185 975	428 030	916	1298	185 967	2094	173
	21	1089	428 119	186 015	428 123	916	1278	186 007	2075	173
	22	-1090	-428 195	-186 047	+428 198	-917	+1257	+186 040	-2054	-173
	23	1090	428 254	186 073	428 257	917	1236	186 066	2033	173
	24	1090	428 300	186 093	428 303	917	1218	186 086	2015	173
	25	1091	428 336	186 109	428 339	917	1206	186 102	2003	173
	26	1091	428 368	186 123	428 371	918	1200	186 116	1997	173
	27	1091	428 403	186 138	428 406	918	1202	186 131	1999	173
	28	-1091	-428 449	-186 158	+428 452	-918	+1210	+186 151	-2008	-173
	29	1091	428 511	186 185	428 514	918	1223	186 178	2021	173
	30	1092	428 595	186 221	428 598	918	1238	186 214	2036	173
July	1	1092	428 701	186 267	428 704	919	1249	186 260	2047	173
	2	-1093	-428 825	-186 321	+428 828	-919	+1252	+186 314	-2051	-174

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2019
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
July	1	+0.150 549 67	-0.915 238 17	-0.396 773 55	+1672 7552	+231 1512	+100 1588
	2	0.167 255 08	0.912 796 15	0.395 715 42	1668 2420	257 2438	111 4624
	3	0.183 912 80	0.910 093 53	0.394 544 39	1663 2158	283 2657	122 7393
	4	0.200 517 68	0.907 131 13	0.393 260 75	1657 6765	309 1984	133 9820
	5	0.217 064 63	0.903 909 92	0.391 864 89	1651 6284	335 0232	145 1829
	6	0.233 548 59	0.900 431 08	0.390 357 26	1645 0804	360 7233	156 3338
	7	+0.249 964 61	-0.896 695 92	-0.388 738 40	+1638 0445	+386 2846	+167 4282
	8	0.266 307 89	0.892 705 89	0.387 008 91	1630 5343	411 6964	178 4603
	9	0.282 573 77	0.888 462 51	0.385 169 42	1622 5644	436 9520	189 4260
	10	0.298 757 69	0.883 967 38	0.383 220 62	1614 1476	462 0477	200 3227
	11	0.314 855 27	0.879 222 10	0.381 163 20	1605 2954	486 9820	211 1486
	12	0.330 862 18	0.874 228 28	0.378 997 88	1596 0173	511 7550	221 9028
	13	+0.346 774 22	-0.868 987 53	-0.376 725 38	+1586 3205	+536 3673	+232 5850
	14	0.362 587 21	0.863 501 46	0.374 346 42	1576 2102	560 8205	243 1952
	15	0.378 297 05	0.857 771 65	0.371 861 72	1565 6899	585 1153	253 7334
	16	0.393 899 65	0.851 799 68	0.369 271 99	1554 7614	609 2522	264 1998
	17	0.409 390 92	0.845 587 13	0.366 577 96	1543 4253	633 2312	274 5943
	18	0.424 766 80	0.839 135 59	0.363 780 35	1531 6806	657 0512	284 9166
	19	+0.440 023 17	-0.832 446 65	-0.360 879 87	+1519 5263	+680 7100	+295 1662
	20	0.455 155 95	0.825 521 94	0.357 877 27	1506 9606	704 2045	305 3418
	21	0.470 161 01	0.818 363 12	0.354 773 29	1493 9813	727 5309	315 4423
	22	0.485 034 19	0.810 971 89	0.351 568 68	1480 5869	750 6842	325 4661
	23	0.499 771 35	0.803 350 03	0.348 264 23	1466 7750	773 6592	335 4114
	24	0.514 368 30	0.795 499 33	0.344 860 72	1452 5438	796 4498	345 2759
	25	+0.528 820 82	-0.787 421 67	-0.341 358 98	+1437 8911	+819 0497	+355 0577
	26	0.543 124 71	0.779 118 99	0.337 759 85	1422 8144	841 4518	364 7541
	27	0.557 275 69	0.770 593 32	0.334 064 19	1407 3107	863 6475	374 3624
	28	0.571 269 49	0.761 846 76	0.330 272 91	1391 3770	885 6277	383 8790
	29	0.585 101 78	0.752 881 52	0.326 386 93	1375 0102	907 3802	393 2998
	30	0.598 768 24	0.743 699 96	0.322 407 25	1358 2084	928 8913	402 6197
	31	+0.612 264 50	-0.734 304 56	-0.318 334 90	+1340 9721	+950 1446	+411 8320
Aug.	1	0.625 586 25	0.724 697 99	0.314 170 99	1323 3053	971 1221	420 9295
	2	0.638 729 21	0.714 883 09	0.309 916 72	1305 2174	991 8058	429 9044
	3	0.651 689 24	0.704 862 90	0.305 573 34	1286 7220	1012 1801	438 7491
	4	0.664 462 34	0.694 640 57	0.301 142 19	1267 8363	1032 2328	447 4578
	5	0.677 044 72	0.684 219 34	0.296 624 65	1248 5791	1051 9569	456 0257
	6	+0.689 432 75	-0.673 602 53	-0.292 022 15	+1228 9685	+1071 3493	+464 4504
	7	0.701 622 97	0.662 793 46	0.287 336 13	1209 0201	1090 4101	472 7307
	8	0.713 612 07	0.651 795 43	0.282 568 02	1188 7470	1109 1418	480 8665
	9	0.725 396 86	0.640 611 71	0.277 719 27	1168 1593	1127 5472	488 8585
	10	0.736 974 23	0.629 245 56	0.272 791 33	1147 2648	1145 6291	496 7073
	11	0.748 341 15	0.617 700 20	0.267 785 60	1126 0696	1163 3898	504 4138
	12	+0.759 494 64	-0.605 978 83	-0.262 703 52	+1104 5780	+1180 8313	+511 9784
	13	0.770 431 74	0.594 084 64	0.257 546 51	1082 7937	1197 9546	519 4017
	14	0.781 149 54	0.582 020 80	0.252 315 96	1060 7191	1214 7600	526 6841
	15	0.791 645 16	0.569 790 50	0.247 013 29	1038 3560	1231 2471	533 8256
	16	+0.801 915 70	-0.557 396 92	-0.241 639 92	+1015 7056	+1247 4147	+540 8258

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2019

MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
July	1	-1092	-428 701	-186 267	+428 704	-919	+1249	+186 260	-2047	-173
	2	1093	428 825	186 321	428 828	919	1252	186 314	2051	174
	3	1094	428 958	186 379	428 961	920	1244	186 372	2043	174
	4	1094	429 086	186 434	429 089	921	1224	186 427	2024	174
	5	1095	429 195	186 482	429 198	921	1194	186 475	1994	174
	6	1095	429 277	186 518	429 280	921	1160	186 511	1961	174
	7	-1096	-429 333	-186 542	+429 336	-922	+1129	+186 535	-1930	-174
	8	1096	429 369	186 558	429 372	922	1106	186 551	1907	174
	9	1096	429 398	186 570	429 400	922	1095	186 563	1896	174
	10	1096	429 430	186 584	429 433	922	1094	186 578	1895	174
	11	1096	429 477	186 604	429 480	922	1101	186 598	1903	174
	12	1097	429 543	186 633	429 545	923	1112	186 626	1914	174
	13	-1097	-429 628	-186 670	+429 631	-923	+1122	+186 663	-1924	-174
	14	1098	429 728	186 713	429 731	923	1128	186 707	1930	174
	15	1098	429 837	186 761	429 840	924	1125	186 754	1928	174
	16	1099	429 947	186 808	429 950	924	1114	186 802	1918	174
	17	1099	430 050	186 853	430 053	925	1096	186 847	1899	175
	18	1100	430 140	186 892	430 142	925	1071	186 886	1874	175
	19	-1100	-430 213	-186 924	+430 216	-925	+1042	+186 918	-1847	-175
	20	1100	430 269	186 948	430 272	926	1014	186 942	1818	175
	21	1101	430 310	186 966	430 313	926	988	186 960	1792	175
	22	1101	430 340	186 979	430 342	926	967	186 973	1772	175
	23	1101	430 364	186 989	430 366	926	952	186 984	1757	175
	24	1101	430 388	187 000	430 390	926	945	186 994	1750	175
	25	-1101	-430 419	-187 013	+430 421	-926	+945	+187 008	-1750	-175
	26	1101	430 464	187 033	430 466	927	950	187 027	1755	175
	27	1102	430 527	187 061	430 530	927	958	187 055	1763	175
	28	1102	430 612	187 097	430 615	927	964	187 091	1770	175
	29	1103	430 717	187 143	430 719	928	966	187 137	1772	175
	30	1103	430 835	187 194	430 837	928	957	187 188	1764	175
	31	-1104	-430 954	-187 246	+430 957	-929	+936	+187 240	-1743	-175
Aug.	1	1104	431 062	187 292	431 064	929	904	187 287	1712	175
	2	1105	431 144	187 328	431 147	929	866	187 323	1673	175
	3	1105	431 197	187 351	431 200	930	827	187 346	1635	176
	4	1105	431 226	187 364	431 228	930	795	187 359	1603	176
	5	1105	431 241	187 370	431 243	930	775	187 365	1583	176
	6	-1105	-431 256	-187 377	+431 259	-930	+768	+187 372	-1576	-176
	7	1106	431 285	187 389	431 287	930	770	187 384	1578	176
	8	1106	431 331	187 410	431 334	930	778	187 405	1586	176
	9	1106	431 398	187 439	431 400	931	785	187 434	1594	176
	10	1107	431 481	187 475	431 483	931	789	187 470	1598	176
	11	1107	431 573	187 515	431 575	931	785	187 510	1595	176
	12	-1108	-431 667	-187 555	+431 669	-932	+774	+187 550	-1583	-176
	13	1108	431 755	187 594	431 757	932	754	187 589	1564	176
	14	1108	431 832	187 627	431 834	932	729	187 622	1539	176
	15	1109	431 893	187 654	431 895	933	699	187 649	1510	176
	16	-1109	-431 938	-187 673	+431 940	-933	+669	+187 668	-1480	-176

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2019
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Aug.	16	+0.801 915 70	-0.557 396 92	-0.241 639 92	+1015 7056	+1247 4147	+540 8258
	17	0.811 958 31	0.544 843 28	0.236 197 25	992 7689	1263 2608	547 6844
	18	0.821 770 13	0.532 132 79	0.230 686 70	969 5465	1278 7824	554 4006
	19	0.831 348 29	0.519 268 72	0.225 109 72	946 0391	1293 9760	560 9732
	20	0.840 689 96	0.506 254 38	0.219 467 72	922 2471	1308 8373	567 4011
	21	0.849 792 29	0.493 093 10	0.213 762 18	898 1710	1323 3615	573 6826
	22	+0.858 652 44	-0.479 788 29	-0.207 994 57	+873 8115	+1337 5429	+579 8158
	23	0.867 267 58	0.466 343 40	0.202 166 37	849 1690	1351 3751	585 7986
	24	0.875 634 88	0.452 761 97	0.196 279 10	824 2436	1364 8509	591 6286
	25	0.883 751 51	0.439 047 60	0.190 334 31	799 0357	1377 9616	597 3028
	26	0.891 614 65	0.425 203 99	0.184 333 58	773 5463	1390 6968	602 8172
	27	0.899 221 50	0.411 234 96	0.178 278 52	747 7771	1403 0442	608 1674
	28	+0.906 569 28	-0.397 144 45	-0.172 170 80	+721 7325	+1414 9893	+613 3476
	29	0.913 655 26	0.382 936 57	0.166 012 15	695 4207	1426 5164	618 3512
	30	0.920 476 84	0.368 615 57	0.159 804 38	668 8546	1437 6103	623 1713
	31	0.927 031 56	0.354 185 85	0.153 549 36	642 0516	1448 2578	627 8017
Sept.	1	0.933 317 16	0.339 651 93	0.147 249 00	615 0331	1458 4504	632 2373
	2	0.939 331 58	0.325 018 37	0.140 905 27	587 8211	1468 1846	636 4751
	3	+0.945 073 00	-0.310 289 76	-0.134 520 16	+560 4367	+1477 4616	+640 5146
	4	0.950 539 80	0.295 470 65	0.128 095 64	532 8974	1486 2864	644 3564
	5	0.955 730 48	0.280 565 52	0.121 633 68	505 2174	1494 6653	648 0026
	6	0.960 643 71	0.265 578 81	0.115 136 23	477 4072	1502 6046	651 4551
	7	0.965 278 22	0.250 514 87	0.108 605 22	449 4749	1510 1101	654 7163
	8	0.969 632 82	0.235 378 03	0.102 042 54	421 4268	1517 1867	657 7882
	9	+0.973 706 39	-0.220 172 56	-0.095 450 08	+393 2682	+1523 8378	+660 6723
	10	0.977 497 83	0.204 902 69	0.088 829 72	365 0036	1530 0662	663 3699
	11	0.981 006 12	0.189 572 63	0.082 183 30	336 6367	1535 8740	665 8823
	12	0.984 230 24	0.174 186 60	0.075 512 68	308 1714	1541 2623	668 2103
	13	0.987 169 23	0.158 748 78	0.068 819 71	279 6108	1546 2320	670 3545
	14	0.989 822 15	0.143 263 36	0.062 106 20	250 9576	1550 7831	672 3155
	15	+0.992 188 08	-0.127 734 52	-0.055 374 01	+222 2147	+1554 9150	+674 0934
	16	0.994 266 15	0.112 166 46	0.048 624 95	193 3840	1558 6263	675 6882
	17	0.996 055 48	0.096 563 40	0.041 860 85	164 4683	1561 9150	677 0995
	18	0.997 555 24	0.080 929 58	0.035 083 57	135 4696	1564 7781	678 3267
	19	0.998 764 60	0.065 269 27	0.028 294 94	106 3904	1567 2121	679 3689
	20	0.999 682 78	0.049 586 78	0.021 496 81	77 2331	1569 2121	680 2245
	21	+1.000 309 01	-0.033 886 49	-0.014 691 07	+48 0007	+1570 7728	+680 8919
	22	1.000 642 56	0.018 172 82	0.007 879 61	+18 6966	1571 8874	681 3689
	23	1.000 682 72	-0.002 450 26	-0.001 064 34	-10 6753	1572 5479	681 6522
	24	1.000 428 85	+0.013 276 60	+0.005 752 78	40 1093	1572 7447	681 7386
	25	0.999 880 35	0.029 003 06	0.012 569 76	69 5974	1572 4670	681 6234
	26	0.999 036 76	0.044 724 32	0.019 384 56	99 1281	1571 7034	681 3018
	27	+0.997 897 70	+0.060 435 47	+0.026 195 09	-128 6861	+1570 4429	+680 7686
	28	0.996 463 01	0.076 131 49	0.032 999 21	158 2513	1568 6773	680 0193
	29	0.994 732 72	0.091 807 32	0.039 794 75	187 8012	1566 4026	679 0512
	30	0.992 707 12	0.107 457 85	0.046 579 50	217 3119	1563 6201	677 8630
Oct.	1	+0.990 386 69	+0.123 078 04	+0.053 351 28	-246 7617	+1560 3355	+676 4560

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2019
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Aug.	16	-1109	-431 938	-187 673	+431 940	-933	+669	+187 668	-1480	-176
	17	1109	431 966	187 685	431 968	933	641	187 681	1452	176
	18	1109	431 981	187 692	431 983	933	618	187 688	1428	176
	19	1109	431 989	187 696	431 991	933	601	187 691	1412	176
	20	1109	431 996	187 699	431 998	933	591	187 694	1402	176
	21	1109	432 008	187 704	432 010	933	589	187 700	1400	176
	22	-1109	-432 031	-187 714	+432 033	-933	+592	+187 710	-1403	-176
	23	1110	432 071	187 731	432 073	933	599	187 727	1410	176
	24	1110	432 130	187 757	432 132	934	607	187 753	1418	176
	25	1110	432 209	187 791	432 211	934	611	187 787	1422	176
	26	1111	432 304	187 832	432 306	934	607	187 828	1419	176
	27	1111	432 405	187 876	432 407	935	593	187 872	1406	176
	28	-1112	-432 501	-187 918	+432 503	-935	+568	+187 914	-1381	-177
	29	1112	432 579	187 952	432 581	936	533	187 948	1346	177
	30	1113	432 629	187 974	432 631	936	495	187 970	1309	177
	31	1113	432 652	187 983	432 653	936	462	187 980	1275	177
Sept.	1	1113	432 654	187 985	432 656	936	439	187 981	1252	177
	2	1113	432 652	187 984	432 654	936	430	187 980	1243	177
	3	-1113	-432 660	-187 987	+432 661	-936	+433	+187 984	-1246	-177
	4	1113	432 686	187 999	432 688	936	443	187 995	1257	177
	5	1113	432 735	188 020	432 736	936	456	188 016	1269	177
	6	1113	432 801	188 049	432 803	937	465	188 045	1279	177
	7	1114	432 880	188 083	432 881	937	468	188 079	1282	177
	8	1114	432 961	188 118	432 963	937	463	188 114	1277	177
	9	-1115	-433 039	-188 152	+433 040	-938	+450	+188 148	-1265	-177
	10	1115	433 105	188 181	433 107	938	430	188 177	1245	177
	11	1115	433 157	188 203	433 159	938	406	188 200	1222	177
	12	1115	433 193	188 219	433 194	938	381	188 215	1197	177
	13	1116	433 212	188 227	433 214	938	358	188 224	1173	177
	14	1116	433 218	188 230	433 220	938	339	188 227	1154	177
	15	-1116	-433 216	-188 229	+433 217	-938	+326	+188 226	-1142	-177
	16	1116	433 211	188 227	433 212	938	321	188 224	1136	177
	17	1116	433 210	188 227	433 212	938	323	188 223	1139	177
	18	1116	433 220	188 231	433 221	938	332	188 228	1147	177
	19	1116	433 245	188 242	433 246	939	345	188 239	1161	177
	20	1116	433 289	188 261	433 290	939	359	188 258	1175	177
	21	-1116	-433 352	-188 288	+433 353	-939	+371	+188 285	-1187	-177
	22	1117	433 431	188 323	433 432	939	378	188 319	1194	177
	23	1117	433 519	188 361	433 521	940	375	188 358	1191	177
	24	1118	433 608	188 399	433 609	940	361	188 396	1178	177
	25	1118	433 684	188 432	433 685	940	338	188 429	1155	178
	26	1118	433 738	188 456	433 740	941	309	188 453	1127	178
	27	-1118	-433 766	-188 468	+433 767	-941	+281	+188 465	-1099	-178
	28	1118	433 771	188 470	433 772	941	261	188 467	1078	178
	29	1118	433 764	188 467	433 765	941	253	188 464	1071	178
	30	1118	433 761	188 466	433 762	941	260	188 463	1077	178
Oct.	1	-1118	-433 776	-188 473	+433 777	-941	+277	+188 470	-1095	-178

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2019
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Oct.	1	+0.990 386 69	+0.123 078 04	+0.053 351 28	-246 7617	+1560 3355	+676 4560
	2	0.987 772 15	0.138 662 92	0.060 107 90	276 1321	1556 5584	674 8333
	3	0.984 864 36	0.154 207 61	0.066 847 24	305 4089	1552 2998	672 9988
	4	0.981 664 32	0.169 707 35	0.073 567 19	334 5820	1547 5702	670 9566
	5	0.978 173 09	0.185 157 47	0.080 265 69	363 6437	1542 3790	668 7108
	6	0.974 391 83	0.200 553 41	0.086 940 74	392 5881	1536 7343	666 2650
	7	+0.970 321 74	+0.215 890 67	+0.093 590 33	-421 4106	+1530 6427	+663 6220
	8	0.965 964 04	0.231 164 80	0.100 212 53	450 1067	1524 1097	660 7847
	9	0.961 320 04	0.246 371 41	0.106 805 39	478 6721	1517 1399	657 7556
	10	0.956 391 05	0.261 506 15	0.113 367 01	507 1029	1509 7375	654 5366
	11	0.951 178 44	0.276 564 73	0.119 895 49	535 3953	1501 9062	651 1299
	12	0.945 683 62	0.291 542 86	0.126 388 99	563 5459	1493 6491	647 5373
	13	+0.939 908 01	+0.306 436 30	+0.132 845 63	-591 5515	+1484 9687	+643 7604
	14	0.933 853 08	0.321 240 83	0.139 263 58	619 4095	1475 8670	639 8006
	15	0.927 520 32	0.335 952 24	0.145 641 03	647 1173	1466 3450	635 6589
	16	0.920 911 24	0.350 566 33	0.151 976 16	674 6723	1456 4029	631 3361
	17	0.914 027 39	0.365 078 89	0.158 267 15	702 0719	1446 0394	626 8323
	18	0.906 870 33	0.379 485 71	0.164 512 20	729 3129	1435 2529	622 1473
	19	+0.899 441 67	+0.393 782 53	+0.170 709 49	-756 3915	+1424 0401	+617 2803
	20	0.891 743 06	0.407 965 07	0.176 857 20	783 3029	1412 3969	612 2302
	21	0.883 776 19	0.422 029 02	0.182 953 48	810 0407	1400 3186	606 9951
	22	0.875 542 85	0.435 969 98	0.188 996 47	836 5969	1387 7992	601 5726
	23	0.867 044 90	0.449 783 51	0.194 984 30	862 9610	1374 8327	595 9602
	24	0.858 284 31	0.463 465 12	0.200 915 03	889 1197	1361 4131	590 1552
	25	+0.849 263 24	+0.477 010 25	+0.206 786 75	-915 0565	+1347 5361	+584 1547
	26	0.839 983 99	0.490 414 31	0.212 597 47	940 7516	1333 1994	577 9571
	27	0.830 449 09	0.503 672 71	0.218 345 23	966 1832	1318 4050	571 5617
	28	0.820 661 28	0.516 780 90	0.224 028 05	991 3296	1303 1595	564 9703
	29	0.810 623 51	0.529 734 43	0.229 643 99	1016 1705	1287 4734	558 1859
	30	0.800 338 94	0.542 528 95	0.235 191 14	1040 6891	1271 3606	551 2136
	31	+0.789 810 85	+0.555 160 27	+0.240 667 66	-1064 8734	+1254 8363	+544 0596
Nov.	1	0.779 042 62	0.567 624 35	0.246 071 75	1088 7145	1237 9154	536 7296
	2	0.768 037 72	0.579 917 30	0.251 401 68	1112 2070	1220 6112	529 2298
	3	0.756 799 65	0.592 035 34	0.256 655 79	1135 3473	1202 9355	521 5654
	4	0.745 331 96	0.603 974 81	0.261 832 46	1158 1325	1184 8984	513 7413
	5	0.733 638 19	0.615 732 13	0.266 930 10	1180 5603	1166 5088	505 7615
	6	+0.721 721 95	+0.627 303 83	+0.271 947 18	-1202 6283	+1147 7747	+497 6301
	7	0.709 586 84	0.638 686 50	0.276 882 21	1224 3341	1128 7031	489 3506
	8	0.697 236 48	0.649 876 80	0.281 733 71	1245 6756	1109 3013	480 9265
	9	0.684 674 55	0.660 871 45	0.286 500 27	1266 6507	1089 5759	472 3613
	10	0.671 904 69	0.671 667 25	0.291 180 48	1287 2583	1069 5326	463 6579
	11	0.658 930 61	0.682 261 06	0.295 772 98	1307 4972	1049 1769	454 8195
	12	+0.645 755 98	+0.692 649 77	+0.300 276 43	-1327 3670	+1028 5134	+445 8486
	13	0.632 384 50	0.702 830 31	0.304 689 51	1346 8670	1007 5452	436 7471
	14	0.618 819 87	0.712 799 66	0.309 010 94	1365 9968	986 2744	427 5167
	15	0.605 065 80	0.722 554 79	0.313 239 42	1384 7550	964 7014	418 1582
	16	+0.591 126 02	+0.732 092 68	+0.317 373 68	-1403 1390	+942 8256	+408 6719

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2019
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Oct.	1	-1118	-433 776	-188 473	+433 777	-941	+277	+188 470	-1095	-178
	2	1119	433 815	188 490	433 816	941	299	188 487	1117	178
	3	1119	433 877	188 516	433 878	941	319	188 513	1137	178
	4	1119	433 954	188 550	433 955	942	333	188 547	1152	178
	5	1120	434 038	188 586	434 039	942	339	188 583	1158	178
	6	1120	434 119	188 622	434 121	942	336	188 619	1155	178
	7	-1121	-434 191	-188 653	+434 193	-943	+326	+188 650	-1145	-178
	8	1121	434 249	188 678	434 250	943	311	188 675	1131	178
	9	1121	434 290	188 696	434 292	943	295	188 693	1114	178
	10	1121	434 316	188 707	434 317	943	279	188 704	1098	178
	11	1121	434 327	188 712	434 329	943	266	188 709	1086	178
	12	1121	434 330	188 713	434 331	943	260	188 710	1080	178
	13	-1121	-434 328	-188 713	+434 329	-943	+261	+188 710	-1081	-178
	14	1121	434 330	188 714	434 331	943	270	188 711	1090	178
	15	1121	434 341	188 719	434 343	943	286	188 716	1106	178
	16	1121	434 368	188 730	434 370	943	307	188 727	1127	178
	17	1122	434 414	188 750	434 415	944	330	188 747	1150	178
	18	1122	434 480	188 779	434 481	944	351	188 775	1171	178
	19	-1122	-434 562	-188 815	+434 563	-944	+366	+188 811	-1187	-178
	20	1123	434 655	188 855	434 657	945	374	188 852	1195	178
	21	1123	434 750	188 896	434 752	945	371	188 893	1192	178
	22	1124	434 837	188 934	434 838	945	359	188 931	1181	178
	23	1124	434 906	188 964	434 908	946	340	188 961	1162	179
	24	1124	434 952	188 984	434 953	946	320	188 981	1142	179
	25	-1125	-434 975	-188 994	+434 976	-946	+304	+188 991	-1126	-179
	26	1125	434 982	188 997	434 983	946	298	188 994	1120	179
	27	1125	434 988	188 999	434 989	946	305	188 996	1127	179
	28	1125	435 005	189 007	435 007	946	325	189 004	1147	179
	29	1125	435 047	189 025	435 048	946	353	189 022	1175	179
	30	1125	435 114	189 054	435 115	947	381	189 051	1204	179
	31	-1126	-435 202	-189 093	+435 204	-947	+405	+189 089	-1228	-179
Nov.	1	1126	435 302	189 136	435 304	947	421	189 133	1244	179
	2	1127	435 404	189 180	435 405	948	426	189 177	1250	179
	3	1127	435 498	189 221	435 499	948	423	189 217	1247	179
	4	1128	435 578	189 256	435 580	949	414	189 252	1239	179
	5	1128	435 642	189 284	435 643	949	402	189 280	1227	179
	6	-1128	-435 689	-189 304	+435 690	-949	+390	+189 300	-1215	-179
	7	1128	435 721	189 318	435 722	949	380	189 314	1205	179
	8	1129	435 742	189 327	435 743	949	376	189 324	1201	179
	9	1129	435 758	189 334	435 760	949	379	189 331	1204	179
	10	1129	435 776	189 342	435 777	950	389	189 338	1214	179
	11	1129	435 801	189 353	435 803	950	407	189 350	1232	179
	12	-1129	-435 842	-189 371	+435 843	-950	+430	+189 367	-1255	-179
	13	1129	435 901	189 397	435 903	950	455	189 393	1281	179
	14	1130	435 981	189 431	435 983	950	480	189 427	1306	179
	15	1130	436 080	189 474	436 082	951	500	189 470	1326	180
	16	-1131	-436 192	-189 523	+436 194	-951	+511	+189 519	-1338	-180

Values are in units of 10^{-8}

POSITION AND VELOCITY OF THE EARTH, 2019
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

Date 0^h T.D.B.		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
Nov.	16	+0.591 126 02	+0.732 092 68	+0.317 373 68	-1403 1390	+942 8256	+408 6719
	17	0.577 004 29	0.741 410 29	0.321 412 43	1421 1446	920 6456	399 0575
	18	0.562 704 41	0.750 504 57	0.325 354 40	1438 7657	898 1594	389 3142
	19	0.548 230 28	0.759 372 45	0.329 198 28	1455 9937	875 3650	379 4412
	20	0.533 585 88	0.768 010 84	0.332 942 79	1472 8177	852 2609	369 4376
	21	0.518 775 32	0.776 416 64	0.336 586 60	1489 2247	828 8474	359 3025
	22	+0.503 802 83	+0.784 586 76	+0.340 128 40	-1505 1993	+805 1264	+349 0363
	23	0.488 672 83	0.792 518 15	0.343 566 89	1520 7245	781 1023	338 6398
	24	0.473 389 90	0.800 207 82	0.346 900 77	1535 7827	756 7834	328 1152
	25	0.457 958 79	0.807 652 88	0.350 128 78	1550 3572	732 1812	317 4665
	26	0.442 384 42	0.814 850 55	0.353 249 70	1564 4327	707 3104	306 6988
	27	0.426 671 84	0.821 798 25	0.356 262 38	1577 9973	682 1881	295 8187
	28	+0.410 826 20	+0.828 493 54	+0.359 165 73	-1591 0433	+656 8326	+284 8337
	29	0.394 852 72	0.834 934 18	0.361 958 73	1603 5661	631 2613	273 7513
	30	0.378 756 63	0.841 118 10	0.364 640 45	1615 5641	605 4906	262 5786
Dec.	1	0.362 543 18	0.847 043 38	0.367 210 02	1627 0376	579 5355	251 3225
	2	0.346 217 62	0.852 708 23	0.369 666 64	1637 9880	553 4086	239 9889
	3	0.329 785 16	0.858 111 01	0.372 009 56	1648 4170	527 1214	228 5832
	4	+0.313 251 01	+0.863 250 16	+0.374 238 08	-1658 3265	+500 6844	+217 1107
	5	0.296 620 36	0.868 124 24	0.376 351 57	1667 7181	474 1074	205 5760
	6	0.279 898 37	0.872 731 88	0.378 349 41	1676 5936	447 3995	193 9836
	7	0.263 090 20	0.877 071 82	0.380 231 06	1684 9551	420 5697	182 3379
	8	0.246 200 97	0.881 142 89	0.381 996 00	1692 8050	393 6262	170 6431
	9	0.229 235 79	0.884 943 99	0.383 643 77	1700 1465	366 5769	158 9031
	10	+0.212 199 73	+0.888 474 10	+0.385 173 93	-1706 9830	+339 4285	+147 1217
	11	0.195 097 80	0.891 732 25	0.386 586 08	1713 3187	312 1862	135 3016
	12	0.177 935 01	0.894 717 52	0.387 879 84	1719 1570	284 8538	123 4453
	13	0.160 716 31	0.897 429 03	0.389 054 87	1724 5010	257 4332	111 5543
	14	0.143 446 63	0.899 865 89	0.390 110 81	1729 3519	229 9250	99 6290
	15	0.126 130 92	0.902 027 24	0.391 047 33	1733 7082	202 3283	87 6697
	16	+0.108 774 13	+0.903 912 17	+0.391 864 09	-1737 5662	+174 6430	+75 6761
	17	0.091 381 28	0.905 519 80	0.392 560 74	1740 9191	146 8692	63 6477
	18	0.073 957 46	0.906 849 26	0.393 136 93	1743 7576	119 0088	51 5848
	19	0.056 507 88	0.907 899 70	0.393 592 32	1746 0708	91 0665	39 4885
	20	0.039 037 84	0.908 670 34	0.393 926 60	1747 8469	63 0489	27 3607
	21	0.021 552 77	0.909 160 46	0.394 139 44	1749 0740	34 9662	15 2047
	22	+0.004 058 22	+0.909 369 49	+0.394 230 61	-1749 7408	+6 8308	+3 0246
	23	-0.013 440 15	0.909 296 95	0.394 199 88	1749 8378	-21 3423	-9 1739
	24	0.030 936 61	0.908 942 57	0.394 047 09	1749 3575	49 5361	21 3844
	25	0.048 425 36	0.908 306 22	0.393 772 17	1748 2956	77 7326	33 5996
	26	0.065 900 58	0.907 387 97	0.393 375 11	1746 6508	105 9131	45 8117
	27	0.083 356 43	0.906 188 07	0.392 855 97	1744 4242	134 0599	58 0132
	28	-0.100 787 14	+0.904 706 94	+0.392 214 91	-1741 6202	-162 1561	-70 1963
	29	0.118 186 93	0.902 945 17	0.391 452 13	1738 2444	190 1868	82 3544
	30	0.135 550 14	0.900 903 47	0.390 567 92	1734 3034	218 1384	94 4810
	31	0.152 871 14	0.898 582 71	0.389 562 63	1729 8043	245 9990	106 5702
	32	-0.170 144 39	+0.895 983 83	+0.388 436 66	-1724 7546	-273 7580	-118 6171

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of 10^{-9} a.u. per day

FRAME BIAS, PRECESSION AND NUTATION, 2019
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

Date 0^h TT		M_{11} - 1	M_{12}	M_{13}	M_{21}	M_{22} - 1	M_{23}	M_{31}	M_{32}	M_{33} - 1
Nov.	16	-1131	-436 192	-189 523	+436 194	-951	+511	+189 519	-1338	-180
	17	1132	436 307	189 573	436 309	952	512	189 569	1340	180
	18	1132	436 415	189 620	436 417	952	504	189 616	1331	180
	19	1133	436 507	189 660	436 509	953	487	189 656	1315	180
	20	1133	436 578	189 690	436 579	953	468	189 686	1296	180
	21	1133	436 625	189 711	436 627	953	451	189 707	1280	180
	22	-1133	-436 656	-189 724	+436 657	-953	+442	+189 720	-1271	-180
	23	1133	436 680	189 735	436 681	953	445	189 731	1273	180
	24	1134	436 711	189 748	436 712	954	460	189 744	1288	180
	25	1134	436 760	189 770	436 762	954	483	189 766	1312	180
	26	1134	436 835	189 802	436 837	954	511	189 798	1340	180
	27	1135	436 934	189 845	436 936	955	536	189 841	1365	180
	28	-1135	-437 051	-189 896	+437 053	-955	+553	+189 892	-1383	-180
	29	1136	437 174	189 949	437 176	956	561	189 945	1391	180
	30	1137	437 293	190 001	437 295	956	559	189 997	1389	181
Dec.	1	1137	437 400	190 047	437 402	957	548	190 043	1379	181
	2	1138	437 490	190 086	437 492	957	533	190 082	1365	181
	3	1138	437 562	190 118	437 563	957	516	190 113	1348	181
	4	-1138	-437 617	-190 141	+437 618	-958	+502	+190 137	-1334	-181
	5	1139	437 659	190 160	437 661	958	491	190 156	1323	181
	6	1139	437 694	190 175	437 695	958	487	190 171	1319	181
	7	1139	437 727	190 189	437 729	958	490	190 185	1322	181
	8	1139	437 766	190 206	437 768	958	500	190 202	1333	181
	9	1139	437 817	190 229	437 819	958	516	190 224	1349	181
	10	-1140	-437 886	-190 258	+437 888	-959	+536	+190 254	-1369	-181
	11	1140	437 975	190 297	437 977	959	556	190 293	1390	181
	12	1141	438 086	190 345	438 087	960	572	190 341	1406	181
	13	1141	438 211	190 400	438 213	960	581	190 395	1415	181
	14	1142	438 344	190 457	438 346	961	578	190 453	1413	181
	15	1143	438 471	190 513	438 473	961	565	190 508	1400	181
	16	-1143	-438 583	-190 561	+438 585	-962	+542	+190 557	-1378	-182
	17	1144	438 672	190 600	438 674	962	516	190 596	1352	182
	18	1144	438 737	190 628	438 738	962	490	190 624	1327	182
	19	1144	438 782	190 647	438 783	963	472	190 643	1308	182
	20	1145	438 817	190 663	438 819	963	464	190 659	1300	182
	21	1145	438 856	190 680	438 857	963	467	190 676	1304	182
	22	-1145	-438 908	-190 702	+438 910	-963	+480	+190 698	-1317	-182
	23	1145	438 983	190 735	438 984	964	498	190 731	1335	182
	24	1146	439 081	190 777	439 082	964	515	190 773	1353	182
	25	1147	439 198	190 828	439 200	964	527	190 824	1365	182
	26	1147	439 326	190 884	439 327	965	530	190 879	1369	182
	27	1148	439 454	190 939	439 455	966	523	190 935	1362	182
	28	-1149	-439 572	-190 991	+439 574	-966	+506	+190 986	-1346	-182
	29	1149	439 675	191 035	439 676	967	483	191 031	1323	182
	30	1149	439 758	191 071	439 760	967	458	191 067	1298	183
	31	1150	439 823	191 099	439 825	967	432	191 096	1273	183
	32	-1150	-439 873	-191 121	+439 874	-967	+411	+191 117	-1251	-183

Values are in units of 10^{-8}

APPARENT PLACES OF POLARIS, 2019

FOR 0^h TERRESTRIAL TIME

	α Ursae Minoris												Mag. 2.02									Sp. F8v			
	JANUARY						FEBRUARY						MARCH						APRIL					
Date	Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
1	2	56	45	+89	20	48	2	55	53	+89	20	53	2	54	60	+89	20	52	2	54	16	+89	20	46
2	2	56	44	+89	20	48	2	55	51	+89	20	53	2	54	58	+89	20	52	2	54	15	+89	20	45
3	2	56	43	+89	20	48	2	55	49	+89	20	53	2	54	57	+89	20	52	2	54	13	+89	20	45
4	2	56	42	+89	20	49	2	55	47	+89	20	53	2	54	55	+89	20	51	2	54	12	+89	20	45
5	2	56	40	+89	20	49	2	55	45	+89	20	53	2	54	53	+89	20	51	2	54	11	+89	20	44
6	2	56	39	+89	20	49	2	55	43	+89	20	53	2	54	51	+89	20	51	2	54	10	+89	20	44
7	2	56	37	+89	20	49	2	55	41	+89	20	53	2	54	49	+89	20	51	2	54	10	+89	20	44
8	2	56	36	+89	20	50	2	55	39	+89	20	53	2	54	47	+89	20	51	2	54	09	+89	20	43
9	2	56	34	+89	20	50	2	55	37	+89	20	53	2	54	45	+89	20	51	2	54	08	+89	20	43
10	2	56	32	+89	20	50	2	55	34	+89	20	53	2	54	44	+89	20	50	2	54	08	+89	20	43
11	2	56	30	+89	20	50	2	55	33	+89	20	53	2	54	42	+89	20	50	2	54	08	+89	20	43
12	2	56	28	+89	20	50	2	55	31	+89	20	53	2	54	41	+89	20	50	2	54	07	+89	20	42
13	2	56	27	+89	20	51	2	55	29	+89	20	53	2	54	39	+89	20	50	2	54	07	+89	20	42
14	2	56	25	+89	20	51	2	55	27	+89	20	53	2	54	38	+89	20	50	2	54	06	+89	20	42
15	2	56	23	+89	20	51	2	55	26	+89	20	53	2	54	37	+89	20	49	2	54	05	+89	20	42
16	2	56	21	+89	20	51	2	55	24	+89	20	53	2	54	36	+89	20	49	2	54	05	+89	20	41
17	2	56	20	+89	20	51	2	55	22	+89	20	53	2	54	34	+89	20	49	2	54	04	+89	20	41
18	2	56	18	+89	20	51	2	55	20	+89	20	53	2	54	33	+89	20	49	2	54	03	+89	20	41
19	2	56	17	+89	20	51	2	55	18	+89	20	53	2	54	31	+89	20	49	2	54	03	+89	20	40
20	2	56	15	+89	20	52	2	55	16	+89	20	53	2	54	30	+89	20	49	2	54	03	+89	20	40
21	2	56	14	+89	20	52	2	55	14	+89	20	53	2	54	28	+89	20	48	2	54	02	+89	20	40
22	2	56	12	+89	20	52	2	55	12	+89	20	53	2	54	27	+89	20	48	2	54	02	+89	20	39
23	2	56	10	+89	20	52	2	55	10	+89	20	52	2	54	25	+89	20	48	2	54	02	+89	20	39
24	2	56	08	+89	20	52	2	55	08	+89	20	52	2	54	24	+89	20	47	2	54	02	+89	20	39
25	2	56	06	+89	20	52	2	55	06	+89	20	52	2	54	23	+89	20	47	2	54	02	+89	20	38
26	2	56	04	+89	20	52	2	55	05	+89	20	52	2	54	22	+89	20	47	2	54	02	+89	20	38
27	2	56	02	+89	20	52	2	55	03	+89	20	52	2	54	21	+89	20	47	2	54	02	+89	20	38
28	2	55	60	+89	20	53	2	55	02	+89	20	52	2	54	20	+89	20	46	2	54	02	+89	20	38
29	2	55	58	+89	20	53							2	54	19	+89	20	46	2	54	02	+89	20	37
30	2	55	56	+89	20	53							2	54	18	+89	20	46	2	54	01	+89	20	37
31	2	55	55	+89	20	53							2	54	17	+89	20	46						

APPARENT PLACES OF POLARIS, 2019

FOR 0^h TERRESTRIAL TIME

	α Ursae Minoris												Mag. 2.02									Sp. F8v		
	MAY						JUNE						JULY						AUGUST					
Date	Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
1	2	54	01	+89	20	37	2	54	19	+89	20	28	2	55	03	+89	20	22	2	56	02	+89	20	21
2	2	54	01	+89	20	36	2	54	20	+89	20	28	2	55	05	+89	20	22	2	56	04	+89	20	21
3	2	54	01	+89	20	36	2	54	22	+89	20	27	2	55	07	+89	20	22	2	56	06	+89	20	21
4	2	54	01	+89	20	36	2	54	23	+89	20	27	2	55	08	+89	20	22	2	56	07	+89	20	22
5	2	54	01	+89	20	35	2	54	25	+89	20	27	2	55	10	+89	20	22	2	56	09	+89	20	22
6	2	54	02	+89	20	35	2	54	26	+89	20	27	2	55	12	+89	20	22	2	56	11	+89	20	22
7	2	54	02	+89	20	35	2	54	27	+89	20	27	2	55	13	+89	20	22	2	56	13	+89	20	22
8	2	54	03	+89	20	34	2	54	28	+89	20	26	2	55	15	+89	20	22	2	56	15	+89	20	22
9	2	54	04	+89	20	34	2	54	29	+89	20	26	2	55	16	+89	20	22	2	56	17	+89	20	22
10	2	54	04	+89	20	34	2	54	30	+89	20	26	2	55	18	+89	20	22	2	56	20	+89	20	22
11	2	54	04	+89	20	34	2	54	31	+89	20	26	2	55	20	+89	20	22	2	56	22	+89	20	22
12	2	54	05	+89	20	33	2	54	33	+89	20	26	2	55	22	+89	20	21	2	56	24	+89	20	22
13	2	54	05	+89	20	33	2	54	34	+89	20	25	2	55	24	+89	20	21	2	56	26	+89	20	22
14	2	54	05	+89	20	33	2	54	35	+89	20	25	2	55	26	+89	20	21	2	56	28	+89	20	22
15	2	54	05	+89	20	33	2	54	37	+89	20	25	2	55	28	+89	20	21	2	56	30	+89	20	22
16	2	54	06	+89	20	32	2	54	39	+89	20	25	2	55	31	+89	20	21	2	56	32	+89	20	23
17	2	54	07	+89	20	32	2	54	40	+89	20	24	2	55	32	+89	20	21	2	56	33	+89	20	23
18	2	54	07	+89	20	32	2	54	42	+89	20	24	2	55	34	+89	20	21	2	56	35	+89	20	23
19	2	54	08	+89	20	31	2	54	44	+89	20	24	2	55	36	+89	20	21	2	56	37	+89	20	23
20	2	54	09	+89	20	31	2	54	45	+89	20	24	2	55	38	+89	20	21	2	56	39	+89	20	23
21	2	54	10	+89	20	31	2	54	47	+89	20	24	2	55	40	+89	20	21	2	56	41	+89	20	23
22	2	54	11	+89	20	30	2	54	48	+89	20	24	2	55	41	+89	20	21	2	56	43	+89	20	23
23	2	54	12	+89	20	30	2	54	49	+89	20	24	2	55	43	+89	20	21	2	56	45	+89	20	23
24	2	54	13	+89	20	30	2	54	51	+89	20	23	2	55	45	+89	20	21	2	56	47	+89	20	23
25	2	54	13	+89	20	30	2	54	52	+89	20	23	2	55	47	+89	20	21	2	56	49	+89	20	24
26	2	54	14	+89	20	30	2	54	54	+89	20	23	2	55	49	+89	20	21	2	56	51	+89	20	24
27	2	54	15	+89	20	29	2	54	55	+89	20	23	2	55	51	+89	20	21	2	56	53	+89	20	24
28	2	54	15	+89	20	29	2	54	57	+89	20	23	2	55	53	+89	20	21	2	56	55	+89	20	24
29	2	54	16	+89	20	29	2	54	59	+89	20	23	2	55	56	+89	20	21	2	56	57	+89	20	24
30	2	54	17	+89	20	28	2	55	01	+89	20	22	2	55	58	+89	20	21	2	56	59	+89	20	25
31	2	54	18	+89	20	28							2	55	60	+89	20	21	2	57	00	+89	20	25

APPARENT PLACES OF POLARIS, 2019

FOR 0^h TERRESTRIAL TIME

α Ursae Minoris												Mag. 2.02										Sp. F8v		
	SEPTEMBER						OCTOBER						NOVEMBER						DECEMBER					
Date	Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination			Right Ascension			Declination		
	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"	h	m	s	°	'	"
1	2	57	02	+89	20	25	2	57	51	+89	20	33	2	58	23	+89	20	43	2	58	26	+89	20	54
2	2	57	04	+89	20	25	2	57	53	+89	20	33	2	58	24	+89	20	44	2	58	25	+89	20	55
3	2	57	06	+89	20	25	2	57	55	+89	20	33	2	58	25	+89	20	44	2	58	25	+89	20	55
4	2	57	08	+89	20	26	2	57	56	+89	20	33	2	58	25	+89	20	44	2	58	24	+89	20	55
5	2	57	10	+89	20	26	2	57	58	+89	20	34	2	58	25	+89	20	45	2	58	23	+89	20	56
6	2	57	12	+89	20	26	2	57	59	+89	20	34	2	58	26	+89	20	45	2	58	22	+89	20	56
7	2	57	14	+89	20	26	2	58	00	+89	20	35	2	58	26	+89	20	46	2	58	21	+89	20	56
8	2	57	16	+89	20	26	2	58	02	+89	20	35	2	58	26	+89	20	46	2	58	21	+89	20	57
9	2	57	18	+89	20	27	2	58	03	+89	20	35	2	58	26	+89	20	46	2	58	20	+89	20	57
10	2	57	19	+89	20	27	2	58	04	+89	20	36	2	58	26	+89	20	47	2	58	19	+89	20	57
11	2	57	21	+89	20	27	2	58	05	+89	20	36	2	58	26	+89	20	47	2	58	19	+89	20	58
12	2	57	22	+89	20	27	2	58	05	+89	20	36	2	58	27	+89	20	47	2	58	18	+89	20	58
13	2	57	24	+89	20	28	2	58	06	+89	20	37	2	58	27	+89	20	48	2	58	18	+89	20	58
14	2	57	25	+89	20	28	2	58	07	+89	20	37	2	58	27	+89	20	48	2	58	17	+89	20	59
15	2	57	27	+89	20	28	2	58	08	+89	20	37	2	58	28	+89	20	48	2	58	16	+89	20	59
16	2	57	28	+89	20	28	2	58	09	+89	20	37	2	58	28	+89	20	49	2	58	15	+89	20	59
17	2	57	30	+89	20	29	2	58	11	+89	20	38	2	58	28	+89	20	49	2	58	14	+89	20	60
18	2	57	32	+89	20	29	2	58	12	+89	20	38	2	58	28	+89	20	50	2	58	13	+89	21	00
19	2	57	33	+89	20	29	2	58	13	+89	20	38	2	58	28	+89	20	50	2	58	12	+89	21	00
20	2	57	35	+89	20	29	2	58	14	+89	20	39	2	58	28	+89	20	50	2	58	11	+89	21	01
21	2	57	37	+89	20	30	2	58	15	+89	20	39	2	58	28	+89	20	51	2	58	09	+89	21	01
22	2	57	39	+89	20	30	2	58	16	+89	20	40	2	58	27	+89	20	51	2	58	08	+89	21	01
23	2	57	41	+89	20	30	2	58	17	+89	20	40	2	58	27	+89	20	51	2	58	07	+89	21	01
24	2	57	42	+89	20	30	2	58	18	+89	20	40	2	58	27	+89	20	52	2	58	06	+89	21	02
25	2	57	44	+89	20	31	2	58	18	+89	20	41	2	58	27	+89	20	52	2	58	06	+89	21	02
26	2	57	45	+89	20	31	2	58	19	+89	20	41	2	58	27	+89	20	52	2	58	05	+89	21	02
27	2	57	46	+89	20	31	2	58	19	+89	20	41	2	58	27	+89	20	53	2	58	03	+89	21	03
28	2	57	47	+89	20	32	2	58	20	+89	20	42	2	58	27	+89	20	53	2	58	02	+89	21	03
29	2	57	49	+89	20	32	2	58	21	+89	20	42	2	58	26	+89	20	54	2	58	01	+89	21	03
30	2	57	50	+89	20	32	2	58	22	+89	20	42	2	58	26	+89	20	54	2	57	59	+89	21	03
31							2	58	22	+89	20	43							2	57	58	+89	21	04
32																			2	57	56	+89	21	04

POLARIS TABLE, 2019

LST	0^h		1^h		2^h		3^h		4^h		5^h	
	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0
m	′	′	′	′	′	′	′	′	′	′	′	′
0	-28.2	+27.6	-34.3	+19.3	-38.2	+9.7	-39.3	-0.7	-37.8	-11.0	-33.7	-20.5
3	28.5	27.2	34.6	18.9	38.3	9.2	39.3	1.2	37.7	11.5	33.4	20.9
6	28.9	26.9	34.8	18.4	38.4	8.7	39.3	1.7	37.5	12.0	33.1	21.4
9	29.2	26.5	35.1	17.9	38.5	8.1	39.3	2.2	37.4	12.5	32.8	21.8
12	29.6	26.1	35.3	17.5	38.6	7.6	39.3	2.8	37.2	13.0	32.6	22.2
15	-29.9	+25.7	-35.5	+17.0	-38.7	+7.1	-39.2	-3.3	-37.0	-13.4	-32.3	-22.7
18	30.2	25.3	35.8	16.5	38.8	6.6	39.2	3.8	36.8	13.9	32.0	23.1
21	30.6	24.9	36.0	16.1	38.9	6.1	39.1	4.3	36.6	14.4	31.7	23.5
24	30.9	24.5	36.2	15.6	39.0	5.6	39.1	4.8	36.5	14.9	31.3	23.9
27	31.2	24.1	36.4	15.1	39.0	5.1	39.0	5.4	36.3	15.4	31.0	24.3
30	-31.5	+23.7	-36.6	+14.6	-39.1	+4.5	-38.9	-5.9	-36.1	-15.9	-30.7	-24.7
33	31.8	23.3	36.8	14.1	39.1	4.0	38.8	6.4	35.8	16.3	30.4	25.1
36	32.1	22.8	36.9	13.7	39.2	3.5	38.7	6.9	35.6	16.8	30.0	25.5
39	32.4	22.4	37.1	13.2	39.2	3.0	38.7	7.4	35.4	17.3	29.7	25.9
42	32.7	22.0	37.3	12.7	39.3	2.5	38.6	7.9	35.2	17.8	29.4	26.3
45	-33.0	+21.6	-37.4	+12.2	-39.3	+1.9	-38.4	-8.4	-34.9	-18.2	-29.0	-26.7
48	33.3	21.1	37.6	11.7	39.3	1.4	38.3	8.9	34.7	18.7	28.7	27.1
51	33.6	20.7	37.8	11.2	39.3	0.9	38.2	9.5	34.4	19.1	28.3	27.5
54	33.8	20.2	37.9	10.7	39.3	+0.4	38.1	10.0	34.2	19.6	28.0	27.8
57	34.1	19.8	38.0	10.2	39.3	-0.2	38.0	10.5	33.9	20.0	27.6	28.2
60	-34.3	+19.3	-38.2	+9.7	-39.3	-0.7	-37.8	-11.0	-33.7	-20.5	-27.2	-28.6
Lat. °	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1
0	-.1	-.3	-.1	-.2	.0	-.1	.0	.0	.0	+.1	-.1	+.2
10	-.1	-.2	-.1	-.2	.0	-.1	.0	.0	.0	+.1	-.1	+.2
20	-.1	-.2	.0	-.2	.0	-.1	.0	.0	.0	+.1	.0	+.2
30	-.1	-.1	.0	-.1	.0	-.1	.0	.0	.0	+.1	.0	+.1
40	.0	-.1	.0	-.1	.0	.0	.0	.0	.0	.0	.0	+.1
45	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	+.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
60	+.1	+.1	.0	+.1	.0	+.1	.0	.0	.0	-.1	.0	-.1
62	+.1	+.2	.0	+.1	.0	+.1	.0	.0	.0	-.1	.0	-.1
64	+.1	+.2	.0	+.2	.0	+.1	.0	.0	.0	-.1	+.1	-.2
66	+.1	+.2	+.1	+.2	.0	+.1	.0	.0	.0	-.1	+.1	-.2
Month	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2
Jan.	+.2	-.1	+.2	-.1	+.2	.0	+.2	.0	+.2	+.1	+.1	+.1
Feb.	+.1	-.2	+.1	-.2	+.2	-.2	+.2	-.1	+.3	-.1	+.3	.0
Mar.	-.1	-.3	.0	-.3	+.1	-.3	+.2	-.3	+.2	-.2	+.3	-.1
Apr.	-.2	-.3	-.1	-.3	.0	-.3	.0	-.3	.1	-.3	+.2	-.3
May	-.3	-.2	-.3	-.2	-.2	-.3	-.1	-.3	.0	-.4	+.1	-.4
June	-.3	.0	-.3	-.1	-.3	-.2	-.2	-.3	-.2	-.3	-.1	-.3
July	-.3	+.1	-.3	.0	-.3	.0	-.3	-.1	-.3	-.2	-.2	-.2
Aug.	-.1	+.2	-.2	+.2	-.2	+.1	-.3	+.1	-.3	.0	-.3	-.1
Sept.	.0	+.3	.0	+.3	-.1	+.3	-.2	+.2	-.2	+.2	-.3	+.1
Oct.	+.2	+.3	+.1	+.3	+.1	+.3	.0	+.3	-.1	+.3	-.2	+.3
Nov.	+.4	+.2	+.3	+.3	+.3	+.3	+.2	+.4	.0	+.4	-.1	+.4
Dec.	+.5	.0	+.5	+.2	+.4	+.3	+.3	+.4	+.2	+.4	+.1	+.5

Latitude = Corrected observed altitude of *Polaris* + a_0 + a_1 + a_2
Azimuth of *Polaris* = (b_0 + b_1 + b_2)/ cos (latitude)

POLARIS TABLE, 2019

LST	6^h		7^h		8^h		9^h		10^h		11^h	
	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0
m	′	′	′	′	′	′	′	′	′	′	′	′
0	-27.2	-28.6	-18.9	-34.6	-9.3	-38.3	+0.9	-39.3	+11.1	-37.7	+20.4	-33.5
3	26.8	28.9	18.4	34.9	8.8	38.4	1.4	39.3	11.6	37.5	20.9	33.2
6	26.5	29.3	18.0	35.1	8.3	38.5	2.0	39.3	12.1	37.4	21.3	33.0
9	26.1	29.6	17.5	35.3	7.8	38.6	2.5	39.3	12.5	37.2	21.7	32.7
12	25.7	29.9	17.1	35.6	7.3	38.7	3.0	39.2	13.0	37.0	22.2	32.4
15	-25.3	-30.3	-16.6	-35.8	-6.8	-38.8	+3.5	-39.2	+13.5	-36.9	+22.6	-32.1
18	24.9	30.6	16.1	36.0	6.3	38.9	4.0	39.1	14.0	36.7	23.0	31.8
21	24.5	30.9	15.6	36.2	5.7	39.0	4.5	39.1	14.5	36.5	23.4	31.5
24	24.1	31.3	15.2	36.4	5.2	39.0	5.0	39.0	14.9	36.3	23.8	31.2
27	23.7	31.6	14.7	36.6	4.7	39.1	5.5	38.9	15.4	36.1	24.2	30.9
30	-23.3	-31.9	-14.2	-36.8	-4.2	-39.2	+6.1	-38.8	+15.9	-35.9	+24.6	-30.5
33	22.8	32.2	13.7	37.0	3.7	39.2	6.6	38.8	16.4	35.7	25.0	30.2
36	22.4	32.5	13.2	37.1	3.2	39.2	7.1	38.7	16.8	35.5	25.4	29.9
39	22.0	32.8	12.8	37.3	2.7	39.3	7.6	38.6	17.3	35.2	25.8	29.6
42	21.6	33.0	12.3	37.5	2.2	39.3	8.1	38.5	17.8	35.0	26.2	29.2
45	-21.1	-33.3	-11.8	-37.6	-1.6	-39.3	+8.6	-38.3	+18.2	-34.8	+26.6	-28.9
48	20.7	33.6	11.3	37.8	1.1	39.3	9.1	38.2	18.7	34.5	27.0	28.5
51	20.2	33.9	10.8	37.9	0.6	39.4	9.6	38.1	19.1	34.3	27.3	28.2
54	19.8	34.1	10.3	38.1	-0.1	39.4	10.1	38.0	19.6	34.0	27.7	27.8
57	19.3	34.4	9.8	38.2	+0.4	39.3	10.6	37.8	20.0	33.8	28.1	27.5
60	-18.9	-34.6	-9.3	-38.3	+0.9	-39.3	+11.1	-37.7	+20.4	-33.5	+28.4	-27.1
Lat. °	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1
0	-.1	+.3	-.2	+.2	-.3	+.1	-.3	.0	-.2	-.1	-.2	-.2
10	-.1	+.2	-.2	+.2	-.2	+.1	-.2	.0	-.2	-.1	-.2	-.2
20	-.1	+.2	-.1	+.2	-.2	+.1	-.2	.0	-.2	-.1	-.1	-.2
30	-.1	+.1	-.1	+.1	-.1	+.1	-.1	.0	-.1	-.1	-.1	-.1
40	.0	+.1	-.1	+.1	-.1	.0	-.1	.0	-.1	.0	-.1	-.1
45	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	-.1	.0	.0	+.1	.0	+.1	.0	.0	.0	.0	.0
60	+.1	-.1	+.1	-.1	+.1	-.1	+.1	.0	+.1	+.1	+.1	+.1
62	+.1	-.2	+.1	-.1	+.1	-.1	+.2	.0	+.1	+.1	+.1	+.1
64	+.1	-.2	+.1	-.2	+.2	-.1	+.2	.0	+.2	+.1	+.1	+.2
66	+.1	-.2	+.2	-.2	+.2	-.1	+.2	.0	+.2	+.1	+.2	+.2
Month	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2
Jan.	+.1	+.2	+.1	+.2	.0	+.2	.0	+.2	-.1	+.2	-.1	+.1
Feb.	+.2	+.1	+.2	+.1	+.2	+.2	+.1	+.2	+.1	+.3	.0	+.3
Mar.	+.3	-.1	+.3	-.1	+.3	+.1	+.3	+.2	+.2	+.2	+.1	+.3
Apr.	+.3	-.2	+.3	-.2	+.3	.0	+.3	.0	+.3	+.1	+.3	+.2
May	+.2	-.3	+.2	-.3	+.3	-.2	+.3	-.1	+.4	.0	+.4	+.1
June	.0	-.3	+.1	-.3	+.2	-.3	+.3	-.2	+.3	-.2	+.3	-.1
July	-.1	-.3	.0	-.3	.0	-.3	+.1	-.3	+.2	-.3	+.2	-.2
Aug.	-.2	-.1	-.2	-.1	-.1	-.2	-.1	-.3	.0	-.3	+.1	-.3
Sept.	-.3	.0	-.3	.0	-.3	-.1	-.2	-.2	-.2	-.2	-.1	-.3
Oct.	-.3	+.2	-.3	+.2	-.3	+.1	-.3	.0	-.3	-.1	-.3	-.2
Nov.	-.2	+.4	-.3	+.4	-.3	+.3	-.4	+.2	-.4	.0	-.4	-.1
Dec.	.0	+.5	-.2	+.5	-.3	+.4	-.4	+.3	-.4	+.2	-.5	+.1

Latitude = Corrected observed altitude of *Polaris* + $a_0 + a_1 + a_2$
Azimuth of *Polaris* = $(b_0 + b_1 + b_2)$/ cos (latitude)

POLARIS TABLE, 2019

LST	12^h		13^h		14^h		15^h		16^h		17^h	
	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0
m	′	′	′	′	′	′	′	′	′	′	′	′
0	+28.4	-27.1	+34.5	-18.9	+38.2	-9.4	+39.3	+0.7	+37.9	+10.7	+33.8	+20.0
3	28.8	26.7	34.7	18.4	38.3	8.9	39.3	1.2	37.7	11.2	33.5	20.4
6	29.1	26.3	35.0	18.0	38.4	8.4	39.3	1.7	37.6	11.7	33.3	20.9
9	29.5	26.0	35.2	17.5	38.5	7.9	39.3	2.2	37.4	12.1	33.0	21.3
12	29.8	25.6	35.4	17.1	38.6	7.4	39.3	2.7	37.2	12.6	32.7	21.7
15	+30.1	-25.2	+35.6	-16.6	+38.7	-6.9	+39.2	+3.2	+37.1	+13.1	+32.4	+22.2
18	30.5	24.8	35.8	16.1	38.8	6.4	39.2	3.7	36.9	13.6	32.1	22.6
21	30.8	24.4	36.1	15.7	38.9	5.9	39.1	4.2	36.7	14.1	31.8	23.0
24	31.1	24.0	36.3	15.2	39.0	5.4	39.1	4.7	36.5	14.5	31.5	23.4
27	31.4	23.6	36.4	14.7	39.0	4.9	39.0	5.2	36.3	15.0	31.2	23.8
30	+31.7	-23.2	+36.6	-14.3	+39.1	-4.4	+38.9	+5.7	+36.1	+15.5	+30.9	+24.2
33	32.0	22.8	36.8	13.8	39.2	3.9	38.8	6.2	35.9	15.9	30.6	24.6
36	32.3	22.3	37.0	13.3	39.2	3.4	38.8	6.7	35.7	16.4	30.3	25.0
39	32.6	21.9	37.2	12.8	39.2	2.9	38.7	7.2	35.5	16.9	29.9	25.4
42	32.9	21.5	37.3	12.3	39.3	2.4	38.6	7.7	35.3	17.3	29.6	25.8
45	+33.2	-21.1	+37.5	-11.9	+39.3	-1.9	+38.5	+8.2	+35.0	+17.8	+29.3	+26.2
48	33.4	20.6	37.6	11.4	39.3	1.4	38.4	8.7	34.8	18.2	28.9	26.6
51	33.7	20.2	37.8	10.9	39.3	0.9	38.2	9.2	34.6	18.7	28.6	26.9
54	34.0	19.8	37.9	10.4	39.3	-0.4	38.1	9.7	34.3	19.1	28.2	27.3
57	34.2	19.3	38.1	9.9	39.3	+0.1	38.0	10.2	34.1	19.6	27.9	27.7
60	+34.5	-18.9	+38.2	-9.4	+39.3	+0.7	+37.9	+10.7	+33.8	+20.0	+27.5	+28.0
Lat. °	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1
0	-.1	-.3	-.1	-.2	.0	-.1	.0	.0	.0	+.1	-.1	+.2
10	-.1	-.2	-.1	-.2	.0	-.1	.0	.0	.0	+.1	-.1	+.2
20	-.1	-.2	.0	-.2	.0	-.1	.0	.0	.0	+.1	.0	+.2
30	-.1	-.1	.0	-.1	.0	-.1	.0	.0	.0	+.1	.0	+.1
40	.0	-.1	.0	-.1	.0	.0	.0	.0	.0	.0	.0	+.1
45	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	+.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
60	+.1	+.1	.0	+.1	.0	+.1	.0	.0	.0	-.1	.0	-.1
62	+.1	+.2	.0	+.1	.0	+.1	.0	.0	.0	-.1	.0	-.1
64	+.1	+.2	.0	+.2	.0	+.1	.0	.0	.0	-.1	+.1	-.2
66	+.1	+.2	+.1	+.2	.0	+.1	.0	.0	.0	-.1	+.1	-.2
Month	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2
Jan.	-.2	+.1	-.2	+.1	-.2	.0	-.2	.0	-.2	-.1	-.1	-.1
Feb.	-.1	+.2	-.1	+.2	-.2	+.2	-.2	+.1	-.3	+.1	-.3	.0
Mar.	+.1	+.3	.0	+.3	-.1	+.3	-.2	+.3	-.2	+.2	-.3	+.1
Apr.	+.2	+.3	+.1	+.3	.0	+.3	.0	+.3	-.1	+.3	-.2	+.3
May	+.3	+.2	+.3	+.2	+.2	+.3	+.1	+.3	.0	+.4	-.1	+.4
June	+.3	.0	+.3	+.1	+.3	+.2	+.2	+.3	+.2	+.3	+.1	+.3
July	+.3	-.1	+.3	.0	+.3	.0	+.3	+.1	+.3	+.2	+.2	+.2
Aug.	+.1	-.2	+.2	-.2	+.2	-.1	+.3	-.1	+.3	.0	+.3	+.1
Sept.	.0	-.3	.0	-.3	+.1	-.3	+.2	-.2	+.2	-.2	+.3	-.1
Oct.	-.2	-.3	-.1	-.3	-.1	-.3	.0	-.3	+.1	-.3	+.2	-.3
Nov.	-.4	-.2	-.3	-.3	-.3	-.3	-.2	-.4	.0	-.4	+.1	-.4
Dec.	-.5	.0	-.5	-.2	-.4	-.3	-.3	-.4	-.2	-.4	-.1	-.5

Latitude = Corrected observed altitude of *Polaris* + a_0 + a_1 + a_2
Azimuth of *Polaris* = (b_0 + b_1 + b_2)/ cos (latitude)

POLARIS TABLE, 2019

LST	18^h		19^h		20^h		21^h		22^h		23^h	
	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0	a_0	b_0
m	′	′	′	′	′	′	′	′	′	′	′	′
0	+27.5	+28.0	+19.3	+34.2	+9.8	+38.0	-0.4	+39.4	-10.6	+38.0	-20.0	+34.0
3	27.1	28.4	18.9	34.4	9.3	38.2	0.9	39.3	11.1	37.8	20.5	33.7
6	26.7	28.7	18.4	34.7	8.8	38.3	1.4	39.3	11.6	37.7	20.9	33.4
9	26.4	29.1	17.9	34.9	8.3	38.4	1.9	39.3	12.1	37.5	21.4	33.2
12	26.0	29.4	17.5	35.1	7.8	38.5	2.5	39.3	12.5	37.4	21.8	32.9
15	+25.6	+29.8	+17.0	+35.4	+7.3	+38.6	-3.0	+39.3	-13.0	+37.2	-22.2	+32.6
18	25.2	30.1	16.6	35.6	6.8	38.7	3.5	39.2	13.5	37.0	22.7	32.3
21	24.8	30.4	16.1	35.8	6.3	38.8	4.0	39.2	14.0	36.9	23.1	32.0
24	24.4	30.7	15.6	36.0	5.8	38.9	4.5	39.1	14.5	36.7	23.5	31.7
27	24.0	31.0	15.2	36.2	5.3	39.0	5.0	39.1	15.0	36.5	23.9	31.4
30	+23.6	+31.4	+14.7	+36.4	+4.7	+39.0	-5.5	+39.0	-15.4	+36.3	-24.3	+31.1
33	23.2	31.7	14.2	36.6	4.2	39.1	6.0	38.9	15.9	36.1	24.7	30.8
36	22.8	32.0	13.7	36.8	3.7	39.2	6.5	38.8	16.4	35.9	25.1	30.4
39	22.3	32.3	13.2	37.0	3.2	39.2	7.1	38.8	16.9	35.7	25.5	30.1
42	21.9	32.6	12.7	37.1	2.7	39.2	7.6	38.7	17.3	35.4	25.9	29.8
45	+21.5	+32.8	+12.3	+37.3	+2.2	+39.3	-8.1	+38.6	-17.8	+35.2	-26.3	+29.4
48	21.1	33.1	11.8	37.5	1.7	39.3	8.6	38.5	18.2	35.0	26.7	29.1
51	20.6	33.4	11.3	37.6	1.2	39.3	9.1	38.4	18.7	34.7	27.1	28.7
54	20.2	33.7	10.8	37.8	0.6	39.3	9.6	38.2	19.2	34.5	27.4	28.4
57	19.7	33.9	10.3	37.9	0.1	39.4	10.1	38.1	19.6	34.2	27.8	28.0
60	+19.3	+34.2	+9.8	+38.0	-+0.4	+39.4	-10.6	+38.0	-20.0	+34.0	-28.2	+27.6
Lat. °	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1	a_1	b_1
0	-.1	+.3	-.2	+.2	-.3	+.1	-.3	.0	-.2	-.1	-.2	-.2
10	-.1	+.2	-.2	+.2	-.2	+.1	-.2	.0	-.2	-.1	-.2	-.2
20	-.1	+.2	-.1	+.2	-.2	+.1	-.2	.0	-.2	-.1	-.1	-.2
30	-.1	+.1	-.1	+.1	-.1	+.1	-.1	.0	-.1	-.1	-.1	-.1
40	.0	+.1	-.1	+.1	-.1	.0	-.1	.0	-.1	.0	-.1	-.1
45	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	-.1	.0	.0	+.1	.0	+.1	.0	.0	.0	.0	.0
60	+.1	-.1	+.1	-.1	+.1	-.1	+.1	.0	+.1	+.1	+.1	+.1
62	+.1	-.2	+.1	-.1	+.1	-.1	+.2	.0	+.1	+.1	+.1	+.1
64	+.1	-.2	+.1	-.2	+.2	-.1	+.2	.0	+.2	+.1	+.1	+.2
66	+.1	-.2	+.2	-.2	+.2	-.1	+.2	.0	+.2	+.1	+.2	+.2
Month	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2	a_2	b_2
Jan.	-.1	-.2	-.1	-.2	.0	-.2	.0	-.2	+.1	-.2	+.1	-.1
Feb.	-.2	-.1	-.2	-.1	-.2	-.2	-.1	-.2	-.1	-.3	.0	-.3
Mar.	-.3	+.1	-.3	.0	-.3	-.1	-.3	-.2	-.2	-.2	-.1	-.3
Apr.	-.3	+.2	-.3	+.1	-.3	.0	-.3	.0	-.3	-.1	-.3	-.2
May	-.2	+.3	-.2	+.3	-.3	+.2	-.3	+.1	-.4	.0	-.4	-.1
June	.0	+.3	-.1	+.3	-.2	+.3	-.3	+.2	-.3	+.2	-.3	+.1
July	+.1	+.3	.0	+.3	.0	+.3	-.1	+.3	-.2	+.3	-.2	+.2
Aug.	+.2	+.1	+.2	+.2	+.1	+.2	+.1	+.3	.0	+.3	-.1	+.3
Sept.	+.3	.0	+.3	.0	+.3	+.1	+.2	+.2	+.2	+.2	+.1	+.3
Oct.	+.3	-.2	+.3	-.1	+.3	-.1	+.3	.0	+.3	+.1	+.3	+.2
Nov.	+.2	-.4	+.3	-.3	+.3	-.3	+.4	-.2	+.4	.0	+.4	+.1
Dec.	.0	-.5	+.2	-.5	+.3	-.4	+.4	-.3	+.4	-.2	+.5	-.1

Latitude = Corrected observed altitude of *Polaris* + a_0 + a_1 + a_2
Azimuth of *Polaris* = (b_0 + b_1 + b_2)/ cos (latitude)

PART - III

SUNRISE, SUNSET AND MOONRISE, MOONSET

SUNRISE, 2019

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude.

Date \ Lat.		0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	5 59	6 16	6 35	6 56	7 08	7 22	7 38	7 59	8 08	8 19	8 31	8 46	9 03
	4	6 01	6 18	6 36	6 56	7 08	7 22	7 38	7 58	8 08	8 18	8 30	8 44	9 01
	8	6 03	6 19	6 37	6 57	7 09	7 22	7 38	7 57	8 06	8 16	8 28	8 42	8 57
	12	6 04	6 20	6 38	6 57	7 08	7 21	7 36	7 55	8 04	8 14	8 25	8 38	8 53
	16	6 06	6 21	6 38	6 57	7 07	7 20	7 34	7 52	8 01	8 10	8 21	8 33	8 47
	20	6 07	6 22	6 38	6 56	7 06	7 18	7 32	7 49	7 57	8 06	8 16	8 27	8 40
	24	6 08	6 22	6 37	6 54	7 04	7 15	7 29	7 45	7 52	8 00	8 10	8 20	8 32
	28	6 09	6 23	6 37	6 53	7 02	7 13	7 25	7 40	7 47	7 54	8 03	8 13	8 24
Feb.	1	6 10	6 22	6 36	6 51	6 59	7 09	7 21	7 34	7 41	7 48	7 56	8 05	8 15
	5	6 10	6 22	6 34	6 48	6 56	7 05	7 16	7 28	7 34	7 41	7 48	7 56	8 05
	9	6 11	6 21	6 33	6 45	6 53	7 01	7 10	7 22	7 27	7 33	7 40	7 47	7 55
	13	6 11	6 20	6 31	6 42	6 49	6 56	7 05	7 15	7 20	7 25	7 31	7 38	7 45
	17	6 11	6 19	6 28	6 39	6 45	6 51	6 59	7 08	7 12	7 17	7 22	7 28	7 34
	21	6 10	6 18	6 26	6 35	6 40	6 46	6 52	7 00	7 04	7 08	7 13	7 17	7 23
	25	6 10	6 16	6 23	6 31	6 35	6 40	6 46	6 53	6 56	6 59	7 03	7 07	7 12
Mar.	1	6 09	6 15	6 20	6 27	6 30	6 34	6 39	6 45	6 47	6 50	6 53	6 56	7 00
	5	6 08	6 13	6 17	6 22	6 25	6 28	6 32	6 36	6 38	6 40	6 43	6 46	6 48
	9	6 07	6 11	6 14	6 18	6 20	6 22	6 25	6 28	6 29	6 31	6 33	6 34	6 37
	13	6 06	6 09	6 11	6 13	6 14	6 16	6 17	6 19	6 20	6 21	6 22	6 23	6 25
	17	6 05	6 06	6 07	6 08	6 09	6 09	6 10	6 11	6 11	6 11	6 12	6 12	6 13
	21	6 04	6 04	6 04	6 03	6 03	6 03	6 03	6 02	6 02	6 02	6 01	6 01	6 00
	25	6 03	6 02	6 00	5 59	5 58	5 56	5 55	5 53	5 53	5 52	5 51	5 50	5 48
	29	6 02	5 59	5 57	5 54	5 52	5 50	5 48	5 45	5 43	5 42	5 40	5 38	5 36
Apr.	2	6 00	5 57	5 53	5 49	5 46	5 44	5 40	5 36	5 34	5 32	5 30	5 27	5 24

BEGINNING OF MORNING TWILIGHT

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	4 44	5 01	5 16	5 30	5 37	5 44	5 52	6 00	6 03	6 06	6 10	6 14	6 18
	8	4 48	5 04	5 19	5 32	5 39	5 45	5 52	5 59	6 02	6 06	6 09	6 12	6 16
	16	4 52	5 07	5 20	5 33	5 39	5 44	5 50	5 56	5 59	6 02	6 04	6 07	6 10
	24	4 55	5 09	5 21	5 31	5 36	5 41	5 46	5 51	5 53	5 55	5 57	5 59	6 01
Feb.	1	4 58	5 10	5 20	5 29	5 33	5 36	5 40	5 43	5 44	5 45	5 46	5 47	5 48
	9	5 00	5 10	5 18	5 24	5 27	5 29	5 31	5 32	5 33	5 33	5 33	5 33	5 33
	17	5 00	5 08	5 14	5 18	5 20	5 20	5 21	5 20	5 19	5 18	5 17	5 16	5 14
	25	5 00	5 06	5 10	5 11	5 11	5 10	5 08	5 05	5 04	5 02	4 59	4 56	4 53
Mar.	5	4 59	5 03	5 04	5 03	5 01	4 59	4 55	4 49	4 46	4 43	4 39	4 35	4 29
	13	4 58	4 59	4 58	4 54	4 50	4 46	4 40	4 31	4 27	4 23	4 17	4 11	4 03
	21	4 55	4 54	4 51	4 44	4 39	4 32	4 24	4 12	4 07	4 01	3 53	3 45	3 35
	29	4 53	4 49	4 43	4 33	4 27	4 18	4 07	3 52	3 45	3 37	3 27	3 16	3 03
Apr.	6	4 50	4 44	4 36	4 23	4 14	4 03	3 50	3 31	3 22	3 12	2 59	2 45	2 26

SUNSET, 2019

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude**.**

Date \ Lat.		0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	18 07	17 49	17 31	17 10	16 58	16 44	16 28	16 07	15 58	15 47	15 34	15 20	15 03
	4	18 08	17 52	17 34	17 13	17 01	16 48	16 31	16 11	16 02	15 51	15 39	15 25	15 09
	8	18 10	17 54	17 36	17 16	17 05	16 51	16 36	16 16	16 07	15 57	15 45	15 32	15 16
	12	18 12	17 56	17 39	17 19	17 08	16 55	16 40	16 22	16 13	16 03	15 52	15 39	15 24
	16	18 13	17 58	17 42	17 23	17 12	17 00	16 45	16 27	16 19	16 10	15 59	15 47	15 33
	20	18 15	18 00	17 44	17 26	17 16	17 04	16 50	16 33	16 26	16 17	16 07	15 55	15 42
	24	18 16	18 02	17 47	17 30	17 20	17 09	16 56	16 40	16 32	16 24	16 15	16 04	15 52
	28	18 16	18 03	17 49	17 33	17 24	17 14	17 01	16 47	16 40	16 32	16 23	16 14	16 02
Feb.	1	18 17	18 05	17 52	17 37	17 28	17 18	17 07	16 53	16 47	16 40	16 32	16 23	16 13
	5	18 17	18 06	17 54	17 40	17 32	17 23	17 13	17 00	16 54	16 48	16 41	16 33	16 23
	9	18 18	18 07	17 56	17 43	17 36	17 28	17 18	17 07	17 02	16 56	16 49	16 42	16 34
	13	18 18	18 08	17 58	17 47	17 40	17 33	17 24	17 14	17 09	17 04	16 58	16 52	16 44
	17	18 17	18 09	18 00	17 50	17 44	17 38	17 30	17 21	17 17	17 12	17 07	17 01	16 55
	21	18 17	18 10	18 02	17 53	17 48	17 42	17 36	17 28	17 24	17 20	17 16	17 11	17 05
	25	18 16	18 10	18 03	17 56	17 52	17 47	17 41	17 34	17 31	17 28	17 24	17 20	17 16
Mar.	1	18 16	18 10	18 05	17 59	17 55	17 51	17 47	17 41	17 39	17 36	17 33	17 30	17 26
	5	18 15	18 11	18 06	18 01	17 59	17 56	17 52	17 48	17 46	17 44	17 41	17 39	17 36
	9	18 14	18 11	18 08	18 04	18 02	18 00	17 57	17 54	17 53	17 52	17 50	17 48	17 46
	13	18 13	18 11	18 09	18 07	18 05	18 04	18 03	18 01	18 00	17 59	17 58	17 57	17 56
	17	18 12	18 11	18 10	18 09	18 09	18 08	18 08	18 07	18 07	18 07	18 06	18 06	18 06
	21	18 11	18 11	18 11	18 12	18 12	18 12	18 13	18 14	18 14	18 14	18 15	18 15	18 16
	25	18 09	18 11	18 12	18 14	18 15	18 17	18 18	18 20	18 21	18 22	18 23	18 24	18 25
	29	18 08	18 11	18 13	18 17	18 18	18 21	18 23	18 26	18 28	18 29	18 31	18 33	18 35
Apr.	2	18 07	18 11	18 14	18 19	18 22	18 25	18 28	18 33	18 35	18 37	18 39	18 42	18 45

END OF EVENING TWILIGHT

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	19 21	19 05	18 50	18 36	18 29	18 22	18 14	18 06	18 03	18 00	17 56	17 52	17 48
	8	19 25	19 09	18 54	18 41	18 34	18 28	18 21	18 14	18 11	18 08	18 05	18 01	17 57
	16	19 27	19 12	18 59	18 47	18 41	18 35	18 29	18 23	18 21	18 18	18 15	18 12	18 09
	24	19 28	19 15	19 03	18 53	18 48	18 43	18 38	18 34	18 32	18 30	18 28	18 26	18 24
Feb.	1	19 29	19 17	19 07	18 59	18 55	18 51	18 48	18 45	18 44	18 43	18 42	18 41	18 40
	9	19 29	19 19	19 11	19 05	19 02	19 00	18 58	18 57	18 57	18 56	18 56	18 57	18 57
	17	19 28	19 20	19 14	19 10	19 09	19 08	19 08	19 09	19 10	19 11	19 12	19 14	19 15
	25	19 26	19 20	19 17	19 16	19 16	19 17	19 19	19 22	19 24	19 26	19 28	19 31	19 35
Mar.	5	19 24	19 21	19 20	19 21	19 23	19 25	19 30	19 35	19 38	19 42	19 46	19 50	19 56
	13	19 22	19 21	19 22	19 26	19 30	19 34	19 41	19 49	19 53	19 58	20 04	20 10	20 18
	21	19 19	19 21	19 24	19 32	19 37	19 43	19 52	20 04	20 09	20 16	20 23	20 32	20 42
	29	19 17	19 21	19 27	19 37	19 44	19 53	20 04	20 19	20 26	20 35	20 45	20 56	21 10
Apr.	6	19 15	19 21	19 30	19 43	19 52	20 03	20 17	20 36	20 45	20 56	21 08	21 24	21 43

SUNRISE, 2019

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING
OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude.

Date \ Lat.		0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	2	6 00	5 57	5 53	5 49	5 46	5 44	5 40	5 36	5 34	5 32	5 30	5 27	5 24
	6	5 59	5 55	5 50	5 44	5 41	5 37	5 33	5 27	5 25	5 22	5 19	5 16	5 12
	10	5 58	5 53	5 47	5 40	5 36	5 31	5 25	5 19	5 16	5 12	5 09	5 05	5 00
	14	5 57	5 51	5 43	5 35	5 30	5 25	5 18	5 11	5 07	5 03	4 59	4 54	4 48
	18	5 56	5 49	5 40	5 31	5 25	5 19	5 11	5 02	4 58	4 54	4 49	4 43	4 36
	22	5 55	5 47	5 37	5 26	5 20	5 13	5 05	4 54	4 50	4 45	4 39	4 32	4 25
	26	5 55	5 45	5 34	5 22	5 15	5 07	4 58	4 47	4 41	4 36	4 29	4 22	4 13
	30	5 54	5 43	5 32	5 19	5 11	5 02	4 52	4 39	4 34	4 27	4 20	4 12	4 02
May	4	5 53	5 42	5 30	5 15	5 07	4 57	4 46	4 32	4 26	4 19	4 11	4 02	3 52
	8	5 53	5 41	5 27	5 12	5 03	4 53	4 40	4 26	4 19	4 11	4 02	3 52	3 41
	12	5 53	5 40	5 25	5 09	4 59	4 48	4 35	4 19	4 12	4 04	3 54	3 43	3 31
	16	5 53	5 39	5 24	5 06	4 56	4 45	4 31	4 14	4 06	3 57	3 47	3 35	3 21
	20	5 53	5 38	5 22	5 04	4 53	4 41	4 26	4 08	4 00	3 50	3 39	3 27	3 13
	24	5 53	5 38	5 21	5 02	4 51	4 38	4 23	4 04	3 55	3 45	3 33	3 20	3 04
	28	5 54	5 38	5 21	5 01	4 49	4 36	4 20	4 00	3 50	3 40	3 28	3 13	2 57
Jun.	1	5 54	5 38	5 20	5 00	4 48	4 34	4 17	3 56	3 47	3 35	3 23	3 08	2 50
	5	5 55	5 38	5 20	4 59	4 46	4 32	4 15	3 54	3 44	3 32	3 19	3 03	2 45
	9	5 56	5 38	5 20	4 58	4 46	4 31	4 14	3 52	3 41	3 29	3 16	3 00	2 41
	13	5 56	5 39	5 20	4 58	4 46	4 31	4 13	3 51	3 40	3 28	3 14	2 57	2 38
	17	5 57	5 40	5 21	4 59	4 46	4 31	4 13	3 50	3 39	3 27	3 13	2 56	2 36
	21	5 58	5 40	5 21	4 59	4 46	4 31	4 13	3 51	3 40	3 27	3 13	2 56	2 36
	25	5 59	5 41	5 22	5 00	4 47	4 32	4 14	3 52	3 41	3 29	3 14	2 58	2 37
	29	6 00	5 42	5 23	5 02	4 49	4 34	4 16	3 54	3 43	3 31	3 17	3 00	2 40
July	3	6 01	5 43	5 25	5 03	4 50	4 36	4 18	3 56	3 45	3 33	3 20	3 03	2 44

BEGINNING OF MORNING TWILIGHT

		0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	6	4 50	4 44	4 36	4 23	4 14	4 03	3 50	3 31	3 22	3 12	2 59	2 45	2 26
	14	4 48	4 39	4 28	4 12	4 02	3 49	3 32	3 09	2 58	2 44	2 28	2 08	1 41
	22	4 45	4 35	4 21	4 02	3 49	3 34	3 14	2 46	2 32	2 15	1 53	1 22	0 12
	30	4 43	4 30	4 14	3 52	3 38	3 20	2 56	2 22	2 04	1 40	1 06		
May	8	4 41	4 27	4 08	3 43	3 27	3 06	2 38	1 57	1 33	0 55			
	16	4 40	4 24	4 04	3 36	3 17	2 54	2 22	1 30	0 53				
	24	4 40	4 22	4 00	3 30	3 09	2 43	2 07	1 00					
June	1	4 40	4 21	3 57	3 25	3 03	2 35	1 54	0 10					
	9	4 41	4 21	3 56	3 23	3 00	2 30	1 45						
	17	4 42	4 22	3 57	3 22	2 59	2 28	1 40						
	25	4 44	4 24	3 58	3 24	3 00	2 29	1 41						
July	3	4 46	4 26	4 01	3 27	3 04	2 34	1 48						
	11	4 47	4 28	4 05	3 32	3 10	2 41	1 59						

SUNSET, 2019

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING
OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude**.**

Date \ Lat.		0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	2	18 07	18 11	18 14	18 19	18 22	18 25	18 28	18 33	18 35	18 37	18 39	18 42	18 45
	6	18 06	18 10	18 16	18 21	18 25	18 29	18 33	18 39	18 41	18 44	18 47	18 51	18 55
	10	18 05	18 10	18 17	18 24	18 28	18 33	18 38	18 45	18 48	18 52	18 55	19 00	19 04
	14	18 04	18 10	18 18	18 26	18 31	18 37	18 43	18 51	18 55	18 59	19 04	19 09	19 14
	18	18 03	18 11	18 19	18 29	18 34	18 41	18 48	18 58	19 02	19 07	19 12	19 18	19 24
	22	18 02	18 11	18 20	18 31	18 38	18 45	18 54	19 04	19 09	19 14	19 20	19 27	19 34
	26	18 01	18 11	18 22	18 34	18 41	18 49	18 59	19 10	19 15	19 21	19 28	19 36	19 44
	30	18 01	18 11	18 23	18 36	18 44	18 53	19 04	19 16	19 22	19 29	19 36	19 44	19 54
May	4	18 00	18 12	18 24	18 39	18 47	18 57	19 08	19 22	19 29	19 36	19 44	19 53	20 04
	8	18 00	18 12	18 26	18 42	18 51	19 01	19 13	19 28	19 36	19 43	19 52	20 02	20 14
	12	18 00	18 13	18 28	18 44	18 54	19 05	19 18	19 34	19 42	19 50	20 00	20 11	20 23
	16	18 00	18 14	18 29	18 47	18 57	19 09	19 23	19 40	19 48	19 57	20 08	20 19	20 33
	20	18 00	18 15	18 31	18 49	19 00	19 12	19 27	19 45	19 54	20 04	20 15	20 27	20 42
	24	18 00	18 16	18 32	18 52	19 03	19 16	19 31	19 51	20 00	20 10	20 22	20 35	20 51
	28	18 01	18 17	18 34	18 54	19 06	19 19	19 35	19 55	20 05	20 16	20 28	20 42	20 59
June	1	18 01	18 18	18 36	18 56	19 08	19 22	19 39	20 00	20 10	20 21	20 34	20 49	21 07
	5	18 02	18 19	18 37	18 58	19 11	19 25	19 42	20 04	20 14	20 25	20 39	20 54	21 13
	9	18 03	18 20	18 39	19 00	19 13	19 27	19 45	20 07	20 17	20 29	20 43	20 59	21 19
	13	18 04	18 21	18 40	19 02	19 15	19 29	19 47	20 10	20 20	20 32	20 46	21 03	21 23
	17	18 04	18 22	18 41	19 03	19 16	19 31	19 49	20 12	20 22	20 35	20 49	21 06	21 26
	21	18 05	18 23	18 42	19 04	19 17	19 32	19 50	20 13	20 24	20 36	20 50	21 07	21 28
	25	18 06	18 24	18 43	19 05	19 18	19 33	19 51	20 13	20 24	20 36	20 51	21 07	21 28
	29	18 07	18 24	18 43	19 05	19 18	19 33	19 51	20 13	20 24	20 36	20 50	21 06	21 26
July	3	18 08	18 25	18 44	19 05	19 18	19 33	19 50	20 12	20 23	20 34	20 48	21 04	21 24

END OF EVENING TWILIGHT

Date		0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	6	19 15	19 21	19 30	19 43	19 52	20 03	20 17	20 36	20 45	20 56	21 08	21 24	21 43
	14	19 13	19 22	19 33	19 49	20 00	20 13	20 31	20 54	21 05	21 19	21 36	21 57	22 26
	22	19 12	19 23	19 37	19 56	20 09	20 25	20 45	21 13	21 28	21 46	22 09	22 42	
	30	19 12	19 24	19 41	20 03	20 18	20 36	21 00	21 35	21 54	22 18	22 56		
May	8	19 12	19 26	19 45	20 10	20 27	20 48	21 16	21 59	22 24	23 05			
	16	19 13	19 29	19 50	20 18	20 36	21 00	21 33	22 26	23 06				
	24	19 14	19 32	19 54	20 25	20 45	21 11	21 49	22 58					
June	1	19 16	19 35	19 58	20 31	20 53	21 21	22 03						
	9	19 18	19 37	20 02	20 36	20 59	21 29	22 15						
	17	19 20	19 40	20 05	20 40	21 03	21 34	22 22						
	25	19 21	19 41	20 07	20 41	21 05	21 36	22 24						
July	3	19 23	19 42	20 07	20 41	21 04	21 34	22 20						
	11	19 23	19 42	20 06	20 39	21 00	21 29	22 11						

SUNRISE, 2019

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING
OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude.

Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 3	6 01	5 43	5 25	5 03	4 50	4 36	4 18	3 56	3 45	3 33	3 20	3 03	2 44
7	6 01	5 44	5 26	5 05	4 52	4 38	4 21	3 59	3 49	3 37	3 24	3 08	2 49
11	6 02	5 45	5 27	5 07	4 55	4 40	4 24	4 03	3 53	3 42	3 29	3 13	2 55
15	6 02	5 46	5 29	5 09	4 57	4 43	4 27	4 07	3 57	3 46	3 34	3 20	3 03
19	6 03	5 47	5 30	5 11	5 00	4 46	4 31	4 12	4 02	3 52	3 40	3 27	3 10
23	6 03	5 48	5 32	5 13	5 02	4 50	4 35	4 16	4 08	3 58	3 47	3 34	3 19
27	6 03	5 49	5 33	5 16	5 05	4 53	4 39	4 22	4 13	4 04	3 54	3 42	3 28
31	6 03	5 49	5 35	5 18	5 08	4 57	4 44	4 27	4 19	4 11	4 01	3 50	3 37
Aug. 4	6 03	5 50	5 36	5 20	5 11	5 01	4 48	4 33	4 26	4 18	4 09	3 58	3 46
8	6 02	5 50	5 38	5 23	5 14	5 04	4 53	4 39	4 32	4 24	4 16	4 07	3 56
12	6 02	5 51	5 39	5 25	5 17	5 08	4 57	4 44	4 38	4 31	4 24	4 15	4 06
16	6 01	5 51	5 40	5 28	5 20	5 12	5 02	4 50	4 45	4 39	4 32	4 24	4 15
20	6 00	5 51	5 41	5 30	5 23	5 16	5 07	4 56	4 51	4 46	4 40	4 33	4 25
24	5 59	5 51	5 42	5 32	5 26	5 20	5 12	5 02	4 58	4 53	4 47	4 41	4 34
28	5 58	5 51	5 43	5 34	5 29	5 23	5 16	5 08	5 04	5 00	4 55	4 50	4 44
Sept. 1	5 57	5 51	5 44	5 37	5 32	5 27	5 21	5 14	5 11	5 07	5 03	4 59	4 54
5	5 56	5 51	5 45	5 39	5 35	5 31	5 26	5 20	5 17	5 14	5 11	5 07	5 03
9	5 54	5 50	5 46	5 41	5 38	5 35	5 31	5 26	5 24	5 21	5 19	5 16	5 12
13	5 53	5 50	5 47	5 43	5 41	5 38	5 35	5 32	5 30	5 28	5 26	5 24	5 22
17	5 51	5 50	5 48	5 45	5 44	5 42	5 40	5 38	5 37	5 36	5 34	5 33	5 31
21	5 50	5 49	5 48	5 47	5 47	5 46	5 45	5 44	5 43	5 43	5 42	5 41	5 40
25	5 49	5 49	5 49	5 50	5 50	5 50	5 50	5 50	5 50	5 50	5 50	5 50	5 50
29	5 47	5 49	5 50	5 52	5 53	5 54	5 55	5 56	5 57	5 57	5 58	5 58	5 59
Oct. 3	5 46	5 49	5 51	5 54	5 56	5 58	6 00	6 02	6 03	6 04	6 06	6 07	6 09

BEGINNING OF MORNING TWILIGHT

Date	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 3	4 46	4 26	4 01	3 27	3 04	2 34	1 48						
11	4 47	4 28	4 05	3 32	3 10	2 41	1 59						
19	4 49	4 31	4 09	3 38	3 17	2 51	2 13	1 01					
27	4 50	4 34	4 13	3 45	3 26	3 02	2 28	1 34	0 50				
Aug. 4	4 51	4 36	4 17	3 51	3 35	3 13	2 44	2 01	1 34	0 49			
12	4 51	4 38	4 21	3 58	3 43	3 25	3 00	2 25	2 05	1 39	0 57		
20	4 50	4 39	4 25	4 05	3 52	3 36	3 15	2 46	2 30	2 12	1 47	1 11	
28	4 48	4 40	4 28	4 11	4 00	3 46	3 29	3 05	2 53	2 38	2 21	1 59	1 27
Sept. 5	4 46	4 40	4 31	4 17	4 08	3 56	3 42	3 22	3 13	3 01	2 48	2 32	2 12
13	4 44	4 40	4 33	4 22	4 15	4 06	3 54	3 38	3 31	3 22	3 12	2 59	2 45
21	4 41	4 40	4 35	4 27	4 22	4 15	4 06	3 53	3 47	3 40	3 32	3 23	3 12
29	4 39	4 39	4 37	4 32	4 28	4 23	4 16	4 07	4 03	3 58	3 52	3 45	3 36
Oct. 7	4 36	4 39	4 39	4 37	4 35	4 32	4 27	4 21	4 17	4 14	4 09	4 04	3 58

SUNSET, 2019

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING
OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude**.**

Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 3	18 08	18 25	18 44	19 05	19 18	19 33	19 50	20 12	20 23	20 34	20 48	21 04	21 24
7	18 08	18 25	18 44	19 05	19 17	19 32	19 49	20 10	20 20	20 32	20 45	21 01	21 20
11	18 09	18 26	18 43	19 04	19 16	19 30	19 47	20 08	20 18	20 29	20 42	20 56	21 14
15	18 10	18 26	18 43	19 03	19 15	19 28	19 44	20 04	20 14	20 25	20 37	20 51	21 08
19	18 10	18 25	18 42	19 01	19 13	19 26	19 41	20 00	20 09	20 20	20 31	20 45	21 01
23	18 10	18 25	18 41	18 59	19 10	19 23	19 38	19 56	20 04	20 14	20 25	20 38	20 52
27	18 10	18 24	18 39	18 57	19 07	19 19	19 33	19 51	19 59	20 08	20 18	20 30	20 44
31	18 10	18 23	18 38	18 54	19 04	19 15	19 29	19 45	19 52	20 01	20 11	20 22	20 34
Aug. 4	18 10	18 22	18 36	18 51	19 01	19 11	19 24	19 39	19 46	19 54	20 03	20 13	20 24
8	18 09	18 21	18 34	18 48	18 57	19 06	19 18	19 32	19 39	19 46	19 54	20 03	20 14
12	18 09	18 19	18 31	18 45	18 52	19 01	19 12	19 25	19 31	19 38	19 45	19 53	20 03
16	18 08	18 18	18 28	18 41	18 48	18 56	19 06	19 17	19 23	19 29	19 36	19 43	19 52
20	18 07	18 16	18 25	18 37	18 43	18 51	18 59	19 10	19 15	19 20	19 26	19 33	19 40
24	18 06	18 14	18 22	18 32	18 38	18 45	18 52	19 02	19 06	19 11	19 16	19 22	19 29
28	18 05	18 12	18 19	18 28	18 33	18 39	18 45	18 54	18 57	19 02	19 06	19 11	19 17
Sept. 1	18 03	18 09	18 16	18 23	18 28	18 32	18 38	18 45	18 48	18 52	18 56	19 00	19 05
5	18 02	18 07	18 12	18 18	18 22	18 26	18 31	18 37	18 39	18 42	18 46	18 49	18 53
9	18 01	18 05	18 09	18 14	18 16	18 20	18 23	18 28	18 30	18 32	18 35	18 38	18 41
13	17 59	18 02	18 05	18 09	18 11	18 13	18 16	18 19	18 21	18 23	18 24	18 27	18 29
17	17 58	18 00	18 01	18 04	18 05	18 06	18 08	18 10	18 11	18 13	18 14	18 15	18 17
21	17 56	17 57	17 58	17 59	17 59	18 00	18 01	18 02	18 02	18 03	18 03	18 04	18 05
25	17 55	17 55	17 54	17 54	17 53	17 53	17 53	17 53	17 53	17 53	17 53	17 53	17 53
29	17 54	17 52	17 50	17 49	17 48	17 47	17 45	17 44	17 43	17 43	17 42	17 41	17 40
Oct. 3	17 52	17 50	17 47	17 44	17 42	17 40	17 38	17 35	17 34	17 33	17 32	17 30	17 28

END OF EVENING TWILIGHT

Date	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 3	19 23	19 42	20 07	20 41	21 04	21 34	22 20						
11	19 23	19 42	20 06	20 39	21 00	21 29	22 11						
19	19 24	19 41	20 04	20 34	20 55	21 21	21 58	23 07					
27	19 23	19 39	20 00	20 28	20 47	21 10	21 43	22 36	23 16				
Aug. 4	19 22	19 36	19 55	20 20	20 37	20 58	21 26	22 09	22 34	23 15			
12	19 20	19 32	19 49	20 11	20 26	20 45	21 09	21 43	22 02	22 27	23 05		
20	19 17	19 28	19 42	20 01	20 14	20 30	20 51	21 19	21 34	21 52	22 15	22 49	
28	19 14	19 23	19 35	19 51	20 02	20 15	20 33	20 56	21 08	21 22	21 39	22 00	22 30
Sept. 5	19 11	19 18	19 27	19 40	19 49	20 00	20 15	20 34	20 43	20 54	21 07	21 23	21 42
13	19 08	19 12	19 19	19 29	19 36	19 45	19 57	20 12	20 20	20 28	20 38	20 50	21 04
21	19 05	19 07	19 11	19 18	19 24	19 31	19 40	19 52	19 58	20 04	20 12	20 21	20 32
29	19 02	19 02	19 03	19 08	19 12	19 17	19 23	19 32	19 37	19 42	19 48	19 54	20 02
Oct. 7	19 00	18 57	18 57	18 58	19 00	19 04	19 08	19 14	19 17	19 21	19 25	19 30	19 36

SUNRISE, 2019

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude.

Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 3	5 46	5 49	5 51	5 54	5 56	5 58	6 00	6 02	6 03	6 04	6 06	6 07	6 09
7	5 45	5 48	5 52	5 56	5 59	6 02	6 05	6 08	6 10	6 12	6 14	6 16	6 18
11	5 44	5 48	5 53	5 59	6 02	6 06	6 10	6 15	6 17	6 19	6 22	6 25	6 28
15	5 43	5 48	5 55	6 01	6 05	6 10	6 15	6 21	6 24	6 27	6 30	6 34	6 38
19	5 42	5 49	5 56	6 04	6 09	6 14	6 20	6 27	6 31	6 34	6 38	6 43	6 48
23	5 41	5 49	5 57	6 07	6 12	6 18	6 25	6 34	6 38	6 42	6 47	6 52	6 58
27	5 41	5 50	5 59	6 10	6 16	6 23	6 31	6 40	6 45	6 50	6 55	7 01	7 08
31	5 40	5 50	6 01	6 13	6 19	6 27	6 36	6 47	6 52	6 57	7 04	7 10	7 18
Nov. 4	5 40	5 51	6 03	6 16	6 23	6 32	6 42	6 54	6 59	7 05	7 12	7 20	7 28
8	5 40	5 52	6 05	6 19	6 27	6 36	6 47	7 00	7 06	7 13	7 21	7 29	7 39
12	5 41	5 53	6 07	6 22	6 31	6 41	6 53	7 07	7 13	7 21	7 29	7 38	7 49
16	5 41	5 55	6 09	6 25	6 35	6 46	6 58	7 13	7 20	7 28	7 37	7 47	7 59
20	5 42	5 56	6 11	6 29	6 39	6 50	7 03	7 20	7 27	7 36	7 45	7 56	8 09
24	5 43	5 58	6 14	6 32	6 43	6 55	7 09	7 26	7 34	7 43	7 53	8 05	8 18
28	5 44	6 00	6 16	6 35	6 46	6 59	7 14	7 32	7 40	7 50	8 01	8 13	8 27
Dec 2	5 46	6 02	6 19	6 38	6 50	7 03	7 18	7 37	7 46	7 56	8 07	8 20	8 36
6	5 47	6 04	6 21	6 42	6 53	7 07	7 23	7 42	7 52	8 02	8 14	8 27	8 43
10	5 49	6 06	6 24	6 45	6 57	7 10	7 27	7 47	7 56	8 07	8 19	8 33	8 50
14	5 51	6 08	6 26	6 47	6 59	7 13	7 30	7 51	8 00	8 11	8 24	8 38	8 55
18	5 53	6 10	6 28	6 50	7 02	7 16	7 33	7 54	8 04	8 15	8 27	8 42	8 59
22	5 55	6 12	6 31	6 52	7 04	7 18	7 35	7 56	8 06	8 17	8 30	8 45	9 02
26	5 57	6 14	6 32	6 54	7 06	7 20	7 37	7 58	8 08	8 19	8 31	8 46	9 03
30	5 59	6 16	6 34	6 55	7 07	7 21	7 38	7 58	8 08	8 19	8 32	8 46	9 03
34	6 00	6 17	6 36	6 56	7 08	7 22	7 38	7 58	8 08	8 19	8 31	8 45	9 02

BEGINNING OF MORNING TWILIGHT

Date	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 7	4 36	4 39	4 39	4 37	4 35	4 32	4 27	4 21	4 17	4 14	4 09	4 04	3 58
15	4 33	4 38	4 41	4 42	4 41	4 40	4 37	4 33	4 31	4 29	4 26	4 23	4 19
23	4 31	4 38	4 43	4 47	4 48	4 48	4 47	4 46	4 45	4 43	4 42	4 40	4 38
31	4 29	4 39	4 46	4 52	4 54	4 56	4 57	4 58	4 58	4 57	4 57	4 57	4 56
Nov. 8	4 29	4 40	4 49	4 57	5 01	5 04	5 07	5 09	5 10	5 11	5 12	5 12	5 13
16	4 28	4 42	4 53	5 03	5 07	5 12	5 16	5 20	5 22	5 24	5 25	5 27	5 29
24	4 29	4 44	4 57	5 08	5 14	5 19	5 25	5 31	5 33	5 35	5 38	5 41	5 43
Dec. 2	4 31	4 47	5 01	5 14	5 20	5 27	5 33	5 40	5 43	5 46	5 49	5 52	5 56
10	4 34	4 51	5 05	5 19	5 26	5 33	5 40	5 48	5 51	5 55	5 58	6 02	6 06
18	4 37	4 55	5 10	5 24	5 31	5 39	5 46	5 54	5 58	6 01	6 05	6 09	6 13
26	4 41	4 59	5 14	5 28	5 35	5 43	5 50	5 58	6 02	6 05	6 09	6 13	6 17
34	4 46	5 02	5 17	5 31	5 38	5 45	5 52	6 00	6 03	6 06	6 10	6 14	6 18
42	4 50	5 06	5 19	5 32	5 39	5 45	5 52	5 59	6 02	6 05	6 08	6 11	6 15

SUNSET, 2019

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING
OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x (82º.5 - λ) mins. or deduct 4 x (λ - 82º.5) mins. as the station is west or east of 82º.5 E. Longitude**.**

Date \ Lat.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 3	17 52	17 50	17 47	17 44	17 42	17 40	17 38	17 35	17 34	17 33	17 32	17 30	17 28
7	17 51	17 47	17 43	17 39	17 37	17 34	17 31	17 27	17 25	17 23	17 21	17 19	17 16
11	17 50	17 45	17 40	17 34	17 31	17 27	17 23	17 18	17 16	17 14	17 11	17 08	17 04
15	17 49	17 43	17 37	17 30	17 26	17 21	17 16	17 10	17 07	17 04	17 01	16 57	16 53
19	17 48	17 41	17 34	17 26	17 21	17 16	17 09	17 02	16 59	16 55	16 51	16 46	16 41
23	17 48	17 40	17 31	17 22	17 16	17 10	17 03	16 54	16 50	16 46	16 41	16 36	16 30
27	17 47	17 38	17 29	17 18	17 12	17 05	16 56	16 47	16 42	16 37	16 32	16 26	16 19
31	17 47	17 37	17 26	17 14	17 07	17 00	16 51	16 40	16 35	16 29	16 23	16 16	16 08
Nov. 4	17 47	17 36	17 24	17 11	17 03	16 55	16 45	16 33	16 27	16 21	16 14	16 07	15 58
8	17 47	17 35	17 23	17 08	17 00	16 51	16 40	16 27	16 20	16 14	16 06	15 58	15 48
12	17 48	17 35	17 21	17 06	16 57	16 47	16 35	16 21	16 14	16 07	15 58	15 49	15 39
16	17 48	17 35	17 20	17 04	16 54	16 43	16 31	16 15	16 08	16 00	15 51	15 41	15 30
20	17 49	17 35	17 19	17 02	16 52	16 41	16 27	16 11	16 03	15 55	15 45	15 34	15 21
24	17 50	17 35	17 19	17 01	16 50	16 38	16 24	16 07	15 59	15 50	15 39	15 28	15 14
28	17 51	17 36	17 19	17 00	16 49	16 36	16 22	16 03	15 55	15 45	15 34	15 22	15 08
Dec. 2	17 53	17 37	17 19	17 00	16 48	16 35	16 20	16 01	15 52	15 42	15 31	15 17	15 02
6	17 55	17 38	17 20	17 00	16 48	16 35	16 19	15 59	15 50	15 39	15 28	15 14	14 58
10	17 56	17 39	17 21	17 00	16 48	16 35	16 18	15 58	15 49	15 38	15 26	15 12	14 55
14	17 58	17 41	17 22	17 01	16 49	16 35	16 19	15 58	15 48	15 37	15 25	15 10	14 53
18	18 00	17 43	17 24	17 03	16 51	16 36	16 20	15 59	15 49	15 38	15 25	15 11	14 53
22	18 02	17 45	17 26	17 05	16 52	16 38	16 21	16 01	15 51	15 40	15 27	15 12	14 54
26	18 04	17 47	17 28	17 07	16 55	16 40	16 24	16 03	15 53	15 42	15 29	15 15	14 57
30	18 06	17 49	17 30	17 09	16 57	16 43	16 27	16 06	15 56	15 46	15 33	15 19	15 02
34	18 08	17 51	17 33	17 12	17 00	16 46	16 30	16 10	16 01	15 50	15 38	15 24	15 07

END OF EVENING TWILIGHT

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 7	19 00	18 57	18 57	18 58	19 00	19 04	19 08	19 14	19 17	19 21	19 25	19 30	19 36
15	18 59	18 53	18 50	18 49	18 50	18 51	18 54	18 57	18 59	19 02	19 04	19 08	19 11
23	18 58	18 50	18 45	18 42	18 41	18 40	18 41	18 42	18 43	18 44	18 46	18 47	18 50
31	18 58	18 48	18 41	18 35	18 33	18 31	18 30	18 29	18 29	18 29	18 29	18 30	18 30
Nov. 8	18 59	18 48	18 38	18 30	18 26	18 23	18 20	18 17	18 17	18 16	18 15	18 14	18 13
16	19 01	18 48	18 36	18 26	18 22	18 17	18 13	18 08	18 07	18 05	18 03	18 01	18 00
24	19 04	18 49	18 36	18 24	18 19	18 13	18 08	18 02	18 00	17 57	17 55	17 52	17 49
Dec. 2	19 07	18 51	18 37	18 24	18 18	18 11	18 05	17 58	17 55	17 52	17 49	17 46	17 42
10	19 11	18 54	18 40	18 26	18 19	18 12	18 05	17 57	17 54	17 50	17 47	17 43	17 39
18	19 15	18 58	18 43	18 28	18 21	18 14	18 06	17 58	17 55	17 51	17 48	17 43	17 39
26	19 19	19 02	18 47	18 32	18 25	18 18	18 11	18 02	17 59	17 55	17 52	17 48	17 43
34	19 23	19 06	18 51	18 37	18 31	18 24	18 16	18 09	18 06	18 02	17 59	17 55	17 51
42	19 26	19 10	18 56	18 43	18 37	18 30	18 24	18 17	18 14	18 11	18 08	18 05	18 01

DURATION OF TWILIGHT, 2019

MORNING AND EVENING TWILIGHT: CIVIL (6°), NAUTICAL (12°)
AND ASTRONOMICAL (18°)

Date	Lat.	0° Civ.	0° Nt.	0° Ast.	10° Civ.	10° Nt.	10° Ast.	20° Civ.	20° Nt.	20° Ast.	30° Civ.	30° Nt.	30° Ast.	40° Civ.	40° Nt.	40° Ast.
		m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
Jan.	0	23	49	75	23	49	75	24	51	79	26	56	85	30	64	97
	8	22	48	74	23	49	75	24	51	78	26	56	85	30	64	96
	16	22	48	74	22	48	74	24	51	77	26	55	84	30	63	95
	24	22	47	73	22	48	73	23	50	76	25	54	83	29	62	94
Feb.	1	22	47	72	22	47	73	23	49	76	25	54	82	29	61	93
	9	21	46	71	22	47	72	23	49	75	25	53	81	28	60	92
	17	21	46	70	21	46	71	22	48	74	24	52	80	28	59	91
	25	21	45	70	21	46	70	22	48	74	24	52	80	27	59	90
Mar.	5	21	45	69	21	46	70	22	48	73	24	52	79	27	59	90
	13	21	45	69	21	45	70	22	48	73	24	52	80	27	58	90
	21	21	45	69	21	45	70	22	48	73	24	52	80	27	59	91
	29	21	45	69	21	46	70	22	48	74	24	52	81	27	59	92
Apr.	6	21	45	69	21	46	71	22	48	75	24	53	82	28	61	95
	14	21	45	70	21	46	71	23	49	76	25	54	83	28	62	97
	22	21	46	70	22	47	72	23	50	77	25	55	85	29	63	100
	30	21	46	71	22	47	73	23	50	77	25	55	87	29	65	103
May	8	22	47	72	22	48	74	23	51	79	26	57	89	30	67	108
	16	22	47	73	22	49	75	24	52	81	26	58	91	31	69	112
	24	22	48	74	23	49	76	24	53	82	27	59	93	32	71	116
June	1	22	48	74	23	50	77	24	53	83	27	60	95	32	73	119
	9	23	49	75	23	50	77	25	54	84	27	61	96	33	74	122
	17	23	49	75	23	50	78	25	54	84	28	61	97	33	75	123
	25	23	49	75	23	50	78	25	54	84	27	61	97	33	75	123
July	3	23	49	75	23	50	77	24	54	84	27	60	96	33	74	122
	11	22	48	74	23	50	77	24	53	83	27	60	95	32	73	119
	19	22	48	74	23	49	76	24	53	82	27	59	93	32	71	115
	27	22	47	73	22	49	75	24	52	80	26	58	91	31	69	111
Aug.	4	22	47	72	22	48	74	23	51	79	26	56	88	30	67	106
	12	21	46	71	22	47	73	23	50	78	25	55	86	29	65	103
	20	21	46	70	22	47	72	23	49	76	25	54	85	29	63	99
	28	21	45	70	21	46	71	22	49	75	25	53	83	28	61	96
Sept.	5	21	45	69	21	46	71	22	48	74	24	53	82	28	60	94
	13	21	45	69	21	46	70	22	48	74	24	52	81	27	59	92
	21	21	45	69	21	45	70	22	48	73	24	52	80	27	59	91
	29	21	45	69	21	45	70	22	48	73	24	52	79	27	58	90
Oct.	7	21	45	69	21	46	70	22	48	73	24	52	79	27	58	90
	15	21	45	70	21	46	70	22	48	74	24	52	80	27	59	90
	23	21	46	70	21	46	71	22	48	74	24	52	80	28	59	91
	31	21	46	71	22	47	72	23	49	75	25	53	81	28	60	92
Nov.	8	22	47	72	22	47	73	23	49	76	25	54	82	29	61	93
	16	22	47	73	22	48	73	23	50	76	25	54	83	29	62	94
	24	22	48	74	22	48	74	24	51	77	26	55	84	30	63	95
Dec.	2	22	48	74	23	49	75	24	51	78	26	56	85	30	64	96
	10	23	49	75	23	49	75	24	51	78	26	56	85	30	64	97
	18	23	49	75	23	49	75	24	52	79	26	56	86	31	65	98
	26	23	49	75	23	49	75	24	52	79	26	56	85	31	65	98
	34	23	49	75	23	49	75	24	51	78	26	56	85	30	64	97

DURATION OF TWILIGHT, 2019
MORNING AND EVENING TWILIGHT: CIVIL (6º), NAUTICAL (12º)
AND ASTRONOMICAL (18º)

Date \ Lat.		45º Civ.	45º Nt.	45º Ast.	50º Civ.	50º Nt.	50º Ast.	55º Civ.	55º Nt.	55º Ast.	60º Civ.	60º Nt.	60º Ast.
		m	m	m	m	m	m	m	m	m	m	m	m
Jan.	0	34	71	106	38	80	119	45	93	137	57	113	165
	8	33	70	105	38	78	117	44	91	135	55	111	161
	16	33	69	104	37	77	116	43	88	132	52	106	156
	24	32	68	102	36	75	113	41	86	129	50	102	151
Feb.	1	31	67	101	35	74	112	40	84	126	48	98	147
	9	31	65	100	34	72	110	39	82	124	45	95	143
	17	30	64	98	33	71	108	38	80	122	44	92	140
	25	30	64	98	33	70	108	37	79	121	42	91	139
Mar.	5	29	63	98	32	70	108	36	78	121	42	90	140
	13	29	64	98	32	70	108	36	79	121	42	90	142
	21	29	64	99	32	71	110	36	80	125	42	92	147
	29	30	65	101	33	72	113	37	81	130	43	95	155
Apr.	6	30	66	104	33	74	117	38	85	137	44	100	169
	14	31	68	108	34	77	123	39	89	147	46	107	193
	22	32	70	112	35	80	130	41	94	161	50	119	**
	30	32	72	117	36	83	139	43	100	184	53	135	**
May	8	33	76	123	38	88	151	46	110	**	59	169	**
	16	35	79	130	40	93	167	49	121	**	65	**	**
	24	36	82	137	42	99	188	52	136	**	74	**	**
June	1	36	84	144	43	104	**	54	156	**	85	**	**
	9	37	86	150	44	108	**	57	194	**	96	**	**
	17	37	87	153	45	110	**	58	**	**	106	**	**
	25	37	87	153	45	110	**	58	**	**	105	**	**
July	3	37	86	150	44	107	**	57	187	**	95	**	**
	11	36	84	144	43	103	**	54	154	**	83	**	**
	19	35	81	137	41	98	186	51	134	**	73	**	**
	27	34	78	129	40	93	165	48	120	**	64	**	**
Aug.	4	33	75	123	38	87	149	45	109	**	58	165	**
	12	32	72	116	36	82	138	42	100	182	53	134	**
	20	31	69	111	35	79	129	41	93	160	49	118	**
	28	31	67	107	34	76	122	39	88	146	46	107	192
Sept.	5	30	66	104	33	74	117	38	84	136	44	100	168
	13	30	65	101	33	72	113	37	81	130	43	95	155
	21	29	64	99	32	71	110	36	79	125	42	92	147
	29	29	63	98	32	70	108	36	78	122	41	90	142
Oct.	7	29	63	97	32	70	107	36	78	121	42	90	139
	15	30	64	98	33	70	107	37	78	121	42	90	139
	23	30	64	98	33	71	108	37	80	121	43	92	140
	31	31	65	99	34	72	109	38	81	123	45	94	142
Nov.	8	31	66	101	35	74	111	40	84	126	47	98	146
	16	32	68	102	36	75	113	41	86	129	50	102	151
	24	33	69	104	37	77	116	43	88	132	52	106	156
Dec.	2	33	70	105	38	78	117	44	91	135	55	110	161
	10	34	71	106	38	80	119	45	92	137	57	113	164
	18	34	71	107	39	80	120	46	93	138	58	115	166
	26	34	71	107	38	80	119	46	93	138	58	114	166
	34	34	71	106	38	79	119	45	92	136	56	112	163

SUNRISE, SUNSET AND TWILIGHT, 2019
CORRECTION FOR SOUTHERN LATITUDES

For	Use	Add	For	Use	Add	For	Use	Add	For	Use	Add	For	Use	Add
July	Dec.	m	Aug.	Feb.	m	Sept.	Mar.	m	Oct.	Apr.	m	Nov.	May	m
1	31	+1	7	3	-8	12	10	-14	19	16	-15	26	25	-10
July	Jan.		8	4	8	13	11	14	20	17	15	27	26	9
2	0	+1	9	5	9	14	12	14	21	18	15	28	27	9
3	1	0	10	6	9	15	13	14	22	19	15	29	28	9
4	2	0	11	7	9	16	14	14	23	20	15	30	29	9
5	3	0	12	8	9	17	15	15	24	21	14	Dec.	May	
6	4	-1	13	9	9	18	16	15	25	22	14	1	30	8
7	5	1	14	10	10	19	17	15	26	23	14	2	31	8
8	6	1	15	11	10	20	18	15	27	24	14	Dec.	June	
9	7	1	16	12	10	21	19	15	28	25	14	3	1	8
10	8	2	17	13	10	22	20	15	29	26	14	4	2	8
11	9	2	18	14	10	23	21	15	30	27	14	5	3	7
12	10	2	19	15	11	24	22	15	31	28	14	6	5	7
13	11	2	20	16	11	25	23	15	Nov.	Apr.		7	6	7
14	12	3	21	17	11	26	24	15	1	29	14	8	7	7
15	13	3	22	18	11	27	25	15	2	30	14	9	8	6
16	14	3	23	19	11	28	26	15	Nov.	May		10	9	6
17	15	3	24	19	12	29	26	15	3	1	13	11	10	6
18	16	3	25	20	12	30	27	15	4	2	13	12	11	6
19	16	4	26	21	12	Oct.	Mar.		5	3	13	13	12	5
20	17	4	27	22	12	1	28	15	6	4	13	14	13	5
21	18	4	28	23	12	2	29	15	7	5	13	15	14	5
22	19	4	29	24	12	3	30	15	8	6	13	16	15	5
23	20	5	30	25	13	4	31	15	9	7	13	17	16	4
24	21	5	31	26	13	Oct.	Apr.		10	8	12	18	17	4
25	22	5	Sept.	Feb.		5	1	16	11	9	12	19	18	4
26	23	6	1	27	13	6	2	16	12	10	12	20	19	4
27	24	6	2	28	13	7	3	16	13	11	12	21	21	3
28	25	6				8	4	15	14	12	12	22	22	3
29	26	6	Sept.	Mar.		9	5	15	15	13	12	23	23	3
30	27	7	3	1	13	10	6	15	16	14	12	24	24	3
31	28	7	4	2	13	11	7	15	17	15	11	25	25	2
Aug.	Jan.		5	3	13	12	9	15	18	17	11	26	26	2
1	29	7	6	4	14	13	10	15	19	18	11	27	27	2
2	30	7	7	5	14	14	11	15	20	19	11	28	28	2
3	30	7	8	6	14	15	12	15	21	20	11	29	29	1
4	31	8	9	7	14	16	13	15	22	21	10	30	30	1
Aug.	Feb.		10	8	14	17	14	15	23	22	10	Dec.	July	
5	1	8	11	9	14	18	15	15	24	23	10	31	1	-1
6	2	-8	12	10	-14	19	16	-15	25	24	-10	32	2	0

To obtain the times of sunrise, sunset and twilight for southern latitudes for any date, use the tables for the same northern latitude for the corresponding date given above, and apply to the times so obtained the correction given in the column headed 'Add'.

In the case of duration of twilight, however, take only the figures for the corresponding date without correction.

SUNRISE, SUNSET AND TWILIGHT, 2019
CORRECTION FOR SOUTHERN LATITUDES

For	Use	Add	For	Use	Add	For	Use	Add	For	Use	Add	For	Use	Add
Jan.	July	m	Feb.	Aug.	m	Mar.	Sept.	m	Apr.	Oct.	m	May	Nov.	m
0	1	0	5	9	+9	13	15	+14	19	22	+15	25	26	+10
1	3	0	6	10	9	14	16	14	20	23	15	26	27	9
2	4	0	7	11	9	15	17	14	21	24	14	27	28	9
			8	12	9	16	18	15	22	25	14	28	29	9
3	5	0	9	13	9	17	19	15	23	26	14	29	30	9
4	6	+1	10	14	10	18	20	15	24	27	14	May	Dec.	
5	7	1	11	15	10	19	21	15	25	28	14	30	1	8
6	8	1	12	16	10	20	22	15	26	29	14	31	2	8
7	9	1	13	17	10	21	23	15	27	30	14	June	Dec.	
8	10	2	14	18	10	22	24	15	28	31	14	1	3	8
9	11	2	15	19	11	23	25	15	Apr.	Nov.		2	4	8
10	12	2	16	20	11	24	26	15	29	1	14	3	5	7
11	13	2	17	21	11	25	27	15	30	2	14	4	5	7
12	14	3	18	22	11	26	29	15	May	Nov.		5	6	7
13	15	3	19	23	11	27	30	15	1	3	13	6	7	7
14	16	3	20	25	12	Mar.	Oct.		2	4	13	7	8	7
15	17	3	21	26	12	28	1	15	3	5	13	8	9	6
16	18	4	22	27	12	29	2	15	4	6	13	9	10	6
17	19	4	23	28	12	30	3	15	5	7	13	10	11	6
18	21	4	24	29	12	31	4	16	6	8	13	11	12	6
19	22	5	25	30	13	Apr.	Oct.		7	9	13	12	13	5
20	23	5	26	31	13	1	5	16	8	10	12	13	14	5
21	24	5				2	6	16	9	11	12	14	15	5
22	25	5	Feb.	Sept.		3	7	16	10	12	12	15	16	5
23	26	6	27	1	13	4	7	15	11	13	12	16	17	4
24	27	6	28	2	13	5	8	15	12	14	12	17	18	4
25	28	6	Mar.	Sept.		6	9	15	13	15	12	18	19	4
26	29	6	1	3	13	7	10	15	14	16	12	19	20	4
27	30	7	2	4	13	8	11	15	15	16	11	20	21	3
28	31	7	3	5	13	9	12	15	16	17	11	21	21	3
Jan.	Aug.		4	6	14	10	13	15	17	18	11	22	22	3
29	1	7	5	7	14	11	14	15	18	19	11	23	23	3
30	2	7	6	8	14	12	15	15	19	20	11	24	24	3
31	3	7	7	9	14	13	16	15	20	21	11	25	25	2
Feb.	Aug.		8	10	14	14	17	15	21	22	10	26	26	2
1	5	8	9	11	14	15	18	15	22	23	10	27	27	2
2	6	8	10	12	14	16	19	15	23	24	10	28	28	1
3	7	8	11	13	14	17	20	15	24	25	10	29	29	1
4	8	+9	12	14	+14	18	21	+15	25	26	+10	30	30	+1

To obtain the times of sunrise, sunset and twilight for southern latitudes for any date, use the tables for the same northern latitude for the corresponding date given above, and apply to the times so obtained the correction given in the column headed 'Add'.

In the case of duration of twilight, however, take only the figures for the corresponding date without correction.

SUNRISE AND SUNSET, 2019

INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

Date	Kolkata 22° N 32'		Varanasi 25° N 18'		Chennai 13° N 00'		Delhi 28° N 35'		Mumbai 18° N 54'	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 0	6 16.3	17 02.7	6 43.3	17 18.4	6 30.8	17 53.0	7 14.0	17 34.5	7 11.7	18 11.4
2	6 16.9	17 04.0	6 43.9	17 19.8	6 31.6	17 54.1	7 14.6	17 35.9	7 12.4	18 12.6
4	6 17.5	17 05.3	6 44.4	17 21.1	6 32.3	17 55.2	7 15.0	17 37.3	7 13.0	18 13.9
6	6 17.9	17 06.6	6 44.8	17 22.5	6 33.0	17 56.3	7 15.3	17 38.8	7 13.6	18 15.1
8	6 18.3	17 08.0	6 45.1	17 24.0	6 33.6	17 57.4	7 15.6	17 40.3	7 14.1	18 16.4
10	6 18.6	17 09.4	6 45.4	17 25.4	6 34.1	17 58.5	7 15.7	17 41.9	7 14.5	18 17.6
12	6 18.8	17 10.8	6 45.5	17 26.9	6 34.6	18 00.0	7 15.7	17 43.4	7 14.8	18 18.9
14	6 19.0	17 12.2	6 45.5	17 28.4	6 35.0	18 00.7	7 15.6	17 45.1	7 15.0	18 20.2
16	6 19.0	17 13.6	6 45.4	17 29.9	6 35.3	18 01.8	7 15.4	17 46.7	7 15.2	18 21.5
18	6 18.9	17 15.1	6 45.3	17 31.5	6 35.6	18 02.8	7 15.1	17 48.3	7 15.2	18 22.8
20	6 18.8	17 16.5	6 45.0	17 33.0	6 35.8	18 03.8	7 14.7	17 50.0	7 15.2	18 24.0
22	6 18.5	17 17.9	6 44.6	17 34.5	6 35.9	18 04.8	7 14.2	17 51.6	7 15.1	18 25.3
24	6 18.2	17 19.3	6 44.2	17 36.0	6 36.0	18 05.8	7 13.5	17 53.3	7 14.9	18 26.5
26	6 17.8	17 20.7	6 43.6	17 37.5	6 35.9	18 06.8	7 12.8	17 54.9	7 14.6	18 27.7
28	6 17.2	17 22.0	6 42.9	17 39.0	6 35.8	18 07.7	7 11.9	17 56.6	7 14.3	18 28.9
30	6 16.6	17 23.4	6 42.2	17 40.5	6 35.7	18 08.6	7 11.0	17 58.2	7 13.8	18 30.1
Feb. 1	6 15.9	17 24.7	6 41.3	17 41.9	6 35.4	18 09.4	7 10.0	18 00.0	7 13.3	18 31.2
3	6 15.2	17 26.0	6 40.4	17 43.4	6 35.1	18 10.2	7 08.8	18 01.4	7 12.7	18 32.3
5	6 14.3	17 27.3	6 39.4	17 44.8	6 34.7	18 11.0	7 07.6	18 03.0	7 12.0	18 33.4
7	6 13.4	17 28.5	6 38.2	17 46.1	6 34.2	18 11.7	7 06.3	18 04.5	7 11.2	18 34.4
9	6 12.4	17 29.7	6 37.1	17 47.5	6 33.7	18 12.4	7 04.9	18 06.1	7 10.4	18 35.5
11	6 11.3	17 30.9	6 35.8	17 48.8	6 33.1	18 13.1	7 03.4	18 07.6	7 09.5	18 36.4
13	6 10.1	17 32.0	6 34.4	17 50.1	6 32.5	18 13.7	7 01.8	18 09.1	7 08.5	18 37.4
15	6 08.9	17 33.1	6 33.0	17 51.4	6 31.8	18 14.3	7 00.2	18 10.6	7 07.5	18 38.3
17	6 07.6	17 34.2	6 31.6	17 52.6	6 31.0	18 14.8	6 58.5	18 12.0	7 06.4	18 39.2
19	6 06.3	17 35.3	6 30.0	17 53.8	6 30.2	18 15.3	6 56.7	18 13.4	7 05.2	18 40.0
21	6 04.9	17 36.3	6 28.4	17 55.0	6 29.3	18 15.8	6 54.9	18 14.9	7 04.0	18 40.8
23	6 03.4	17 37.3	6 26.7	17 56.1	6 28.3	18 16.2	6 53.0	18 16.2	7 02.7	18 41.6
25	6 01.9	17 38.2	6 25.0	17 57.3	6 27.4	18 16.6	6 51.0	18 17.6	7 01.3	18 42.4
27	6 00.3	17 39.2	6 23.3	17 58.4	6 26.3	18 17.0	6 49.0	18 18.9	7 00.0	18 43.1
Mar. 1	5 58.7	17 40.1	6 21.5	17 59.4	6 25.3	18 17.3	6 46.9	18 20.2	6 58.5	18 43.8
3	5 57.1	17 41.0	6 19.6	18 00.5	6 24.1	18 17.7	6 44.8	18 21.5	6 57.1	18 44.4
5	5 55.4	17 41.8	6 17.7	18 01.5	6 23.0	18 17.9	6 42.7	18 22.8	6 55.5	18 45.1
7	5 53.7	17 42.6	6 15.8	18 02.5	6 21.8	18 18.2	6 40.5	18 24.0	6 54.0	18 45.7
9	5 52.0	17 43.4	6 13.9	18 03.4	6 20.6	18 18.4	6 38.3	18 25.2	6 52.4	18 46.3
11	5 50.2	17 44.2	6 11.9	18 04.4	6 19.4	18 18.7	6 36.1	18 26.5	6 50.8	18 46.9
13	5 48.4	17 45.0	6 09.9	18 05.3	6 18.1	18 18.8	6 33.8	18 27.6	6 49.2	18 47.4
15	5 46.5	17 45.8	6 07.9	18 06.3	6 16.9	18 19.0	6 31.5	18 28.8	6 47.5	18 48.0
17	5 44.7	17 46.5	6 05.9	18 07.2	6 15.6	18 19.2	6 29.2	18 30.0	6 45.9	18 48.5
19	5 42.8	17 47.2	6 03.8	18 08.1	6 14.3	18 19.3	6 26.9	18 31.1	6 44.2	18 49.0
21	5 40.9	17 47.9	6 01.8	18 09.0	6 13.0	18 19.5	6 24.6	18 32.3	6 42.5	18 49.5
23	5 39.0	17 48.6	6 00.0	18 09.9	6 11.7	18 19.6	6 22.3	18 33.4	6 40.8	18 50.0
25	5 37.1	17 49.3	5 57.7	18 10.8	6 10.3	18 19.8	6 20.0	18 34.5	6 39.1	18 50.5
27	5 35.2	17 50.0	5 55.6	18 11.6	6 09.0	18 19.9	6 17.7	18 35.7	6 37.4	18 51.0
29	5 33.3	17 50.7	5 53.6	18 12.5	6 07.7	18 20.0	6 15.4	18 36.8	6 35.7	18 51.4
31	5 31.4	17 51.4	5 51.5	18 13.4	6 06.4	18 20.1	6 13.1	18 37.9	6 34.0	18 51.9
Apr. 2	5 29.5	17 52.1	5 49.5	18 14.2	6 05.1	18 20.3	6 10.8	18 39.0	6 32.4	18 52.4

SUNRISE AND SUNSET, 2019
INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

Date		Kolkata 22º N 32'		Varanasi 25º N 18'		Chennai 13º N 00'		Delhi 28º N 35'		Mumbai 18º N 54'	
		Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	2	5 29.5	17 52.1	5 49.5	18 14.2	6 05.1	18 20.3	6 10.8	18 39.0	6 32.4	18 52.4
	4	5 27.6	17 52.8	5 47.4	18 15.1	6 03.8	18 20.4	6 08.5	18 40.1	6 30.7	18 52.9
	6	5 25.7	17 53.5	5 45.4	18 16.0	6 02.5	18 20.5	6 06.3	18 41.3	6 29.1	18 53.4
	8	5 23.9	17 54.2	5 43.4	18 16.9	6 01.3	18 20.7	6 04.1	18 42.4	6 27.4	18 53.9
	10	5 22.0	17 54.9	5 41.4	18 17.8	6 00.0	18 20.9	6 01.9	18 43.5	6 25.8	18 54.4
	12	5 20.2	17 55.6	5 39.5	18 18.7	5 58.8	18 21.0	6 00.0	18 44.7	6 24.3	18 54.9
	14	5 18.5	17 56.4	5 37.5	18 19.6	5 57.6	18 21.2	5 57.7	18 45.8	6 22.7	18 55.4
	16	5 16.7	17 57.1	5 35.6	18 20.5	5 56.5	18 21.4	5 55.6	18 47.0	6 21.2	18 56.0
	18	5 15.0	17 57.8	5 33.8	18 21.4	5 55.4	18 21.7	5 53.5	18 48.1	6 19.7	18 56.5
	20	5 13.4	17 58.6	5 32.0	18 22.4	5 54.3	18 21.9	5 51.5	18 49.3	6 18.3	18 57.1
	22	5 11.7	17 59.4	5 30.2	18 23.3	5 53.2	18 22.2	5 49.6	18 50.5	6 16.9	18 57.7
	24	5 10.1	18 00.1	5 28.4	18 24.3	5 52.2	18 22.4	5 47.6	18 51.7	6 15.6	18 58.3
	26	5 08.6	18 00.9	5 26.8	18 25.3	5 51.2	18 22.8	5 45.8	18 52.9	6 14.3	18 58.9
	28	5 07.1	18 01.8	5 25.1	18 26.3	5 50.2	18 23.1	5 44.0	18 54.1	6 13.0	19 00.0
	30	5 05.7	18 02.6	5 23.5	18 27.3	5 49.3	18 23.4	5 42.2	18 55.3	6 11.8	19 00.2
May	2	5 04.3	18 03.4	5 22.0	18 28.3	5 48.5	18 23.8	5 40.5	18 56.5	6 10.6	19 00.9
	4	5 03.0	18 04.3	5 20.6	18 29.3	5 47.7	18 24.2	5 38.9	18 57.7	6 09.6	19 01.6
	6	5 01.8	18 05.1	5 19.2	18 30.3	5 46.9	18 24.6	5 37.3	18 59.0	6 08.5	19 02.3
	8	5 00.6	18 06.0	5 17.9	18 31.4	5 46.2	18 25.1	5 35.8	19 00.2	6 07.5	19 03.0
	10	4 59.5	18 06.9	5 16.6	18 32.4	5 45.5	18 25.5	5 34.4	19 01.4	6 06.6	19 03.8
	12	4 58.5	18 07.8	5 15.4	18 33.5	5 44.9	18 26.0	5 33.0	19 02.7	6 05.8	19 04.5
	14	4 57.5	18 08.7	5 14.3	18 34.5	5 44.4	18 26.5	5 31.8	19 03.9	6 05.0	19 05.3
	16	4 56.6	18 09.6	5 13.3	18 35.6	5 43.9	18 27.0	5 30.6	19 05.1	6 04.3	19 06.0
	18	4 55.7	18 10.5	5 12.3	18 36.6	5 43.5	18 27.6	5 29.5	19 06.3	6 03.6	19 06.8
	20	4 55.0	18 11.4	5 11.5	18 37.7	5 43.1	18 28.1	5 28.5	19 07.5	6 03.0	19 07.6
	22	4 54.3	18 12.3	5 10.7	18 38.7	5 42.8	18 28.7	5 27.5	19 08.7	6 02.5	19 08.4
	24	4 53.7	18 13.2	5 09.9	18 39.7	5 42.5	18 29.3	5 26.7	19 09.9	6 02.0	19 09.2
	26	4 53.2	18 14.1	5 09.3	18 40.7	5 42.3	18 29.9	5 25.9	19 11.0	6 01.7	19 10.0
	28	4 52.7	18 15.0	5 08.8	18 41.7	5 42.1	18 30.5	5 25.2	19 12.1	6 01.3	19 10.8
	30	4 52.3	18 15.9	5 08.3	18 42.7	5 42.0	18 31.1	5 24.7	19 13.2	6 01.1	19 11.5
June	1	4 52.0	18 16.7	5 07.9	18 43.6	5 42.0	18 31.7	5 24.2	19 14.3	6 00.9	19 12.3
	3	4 51.8	18 17.5	5 07.6	18 44.6	5 42.0	18 32.3	5 23.8	19 15.3	6 00.8	19 13.0
	5	4 51.7	18 18.4	5 07.4	18 45.4	5 42.1	18 32.9	5 23.5	19 16.3	6 00.7	19 13.8
	7	4 51.6	18 19.1	5 07.3	18 46.3	5 42.2	18 33.5	5 23.3	19 17.2	6 00.7	19 14.5
	9	4 51.6	18 19.9	5 07.2	18 47.1	5 42.4	18 34.1	5 23.2	19 18.0	6 00.8	19 15.2
	11	4 51.7	18 20.6	5 07.3	18 47.8	5 42.6	18 34.7	5 23.1	19 18.9	6 00.9	19 15.8
	13	4 51.8	18 21.2	5 07.4	18 48.6	5 42.9	18 35.2	5 23.2	19 19.6	6 01.1	19 16.5
	15	4 52.0	18 21.9	5 07.5	18 49.2	5 43.2	18 35.8	5 23.3	19 20.3	6 01.3	19 17.1
	17	4 52.3	18 22.4	5 07.8	18 49.8	5 43.5	18 36.3	5 23.5	19 20.9	6 01.6	19 17.6
	19	4 52.6	18 23.0	5 08.1	18 50.4	5 43.9	18 36.8	5 23.8	19 21.5	6 02.0	19 18.1
	21	4 53.0	18 23.4	5 08.5	18 50.8	5 44.3	18 37.2	5 24.2	19 22.0	6 02.4	19 18.6
	23	4 53.5	18 23.8	5 08.9	18 51.2	5 44.7	18 37.6	5 24.7	19 22.4	6 02.8	19 19.0
	25	4 54.0	18 24.2	5 09.4	18 51.6	5 45.2	18 38.0	5 25.2	19 22.7	6 03.3	19 19.4
	27	4 54.5	18 24.5	5 10.0	18 51.8	5 45.7	18 38.4	5 25.8	19 22.9	6 03.8	19 19.7
	29	4 55.1	18 24.7	5 10.6	18 52.0	5 46.2	18 38.7	5 26.4	19 23.1	6 04.3	19 19.9
July	1	4 55.8	18 24.8	5 11.3	18 52.1	5 46.7	18 38.9	5 27.1	19 23.1	6 04.9	19 20.1
	3	4 56.4	18 24.9	5 12.0	18 52.2	5 47.2	18 39.1	5 27.9	19 23.1	6 05.5	19 20.2

SUNRISE AND SUNSET, 2019
INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

Date	Kolkata 22º N 32'				Varanasi 25º N 18'				Chennai 13º N 00'				Delhi 28º N 35'				Mumbai 18º N 54'			
	Rise		Set		Rise		Set		Rise		Set		Rise		Set		Rise		Set	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
July 1	4	55.8	18	24.8	5	11.3	18	52.1	5	46.7	18	38.9	5	27.1	19	23.1	6	04.9	19	20.1
3	4	56.4	18	24.9	5	12.0	18	52.2	5	47.2	18	39.1	5	27.9	19	23.1	6	05.5	19	20.2
5	4	57.2	18	24.9	5	12.8	18	52.1	5	47.8	18	39.3	5	28.7	19	23.0	6	06.2	19	20.3
7	4	57.9	18	24.8	5	13.6	18	52.0	5	48.3	18	39.4	5	29.6	19	22.8	6	06.8	19	20.3
9	4	58.7	18	24.7	5	14.4	18	51.8	5	48.9	18	39.5	5	30.5	19	22.5	6	07.5	19	20.2
11	4	59.5	18	24.5	5	15.3	18	51.5	5	49.5	18	39.5	5	31.4	19	22.1	6	08.2	19	20.1
13	5	00.3	18	24.2	5	16.2	18	51.1	5	50.0	18	39.4	5	32.4	19	21.6	6	08.9	19	19.9
15	5	01.1	18	23.8	5	17.1	18	50.6	5	50.6	18	39.3	5	33.4	19	21.0	6	09.6	19	19.6
17	5	01.9	18	23.3	5	18.0	18	50.1	5	51.1	18	39.1	5	34.5	19	20.4	6	10.3	19	19.3
19	5	02.8	18	22.8	5	18.9	18	49.4	5	51.6	18	38.9	5	35.5	19	19.6	6	11.0	19	18.8
21	5	03.6	18	22.2	5	19.9	18	48.7	5	52.2	18	38.6	5	36.6	19	18.7	6	11.7	19	18.3
23	5	04.5	18	21.5	5	20.9	18	47.9	5	52.7	18	38.2	5	37.7	19	17.8	6	12.4	19	17.8
25	5	05.4	18	20.7	5	21.8	18	47.0	5	53.1	18	37.8	5	38.8	19	16.7	6	13.1	19	17.1
27	5	06.2	18	19.9	5	22.8	18	46.0	5	53.6	18	37.3	5	39.9	19	15.6	6	13.8	19	16.4
29	5	07.1	18	18.9	5	23.8	18	44.9	5	54.1	18	36.8	5	41.0	19	14.4	6	14.5	19	15.7
31	5	07.9	18	18.0	5	24.8	18	43.8	5	54.5	18	36.2	5	42.2	19	13.1	6	15.2	19	14.8
Aug. 2	5	08.7	18	16.9	5	25.7	18	42.6	5	54.9	18	35.5	5	43.3	19	11.7	6	15.8	19	13.9
4	5	09.6	18	15.8	5	26.7	18	41.3	5	55.3	18	34.8	5	44.4	19	10.2	6	16.5	19	12.9
6	5	10.4	18	14.6	5	27.6	18	40.0	5	55.6	18	34.1	5	45.5	19	08.7	6	17.1	19	11.9
8	5	11.2	18	13.3	5	28.6	18	38.5	5	56.0	18	33.2	5	46.6	19	07.0	6	17.7	19	10.8
10	5	12.0	18	12.0	5	29.5	18	37.0	5	56.3	18	32.4	5	47.7	19	05.3	6	18.3	19	09.6
12	5	12.7	18	10.6	5	30.4	18	35.5	5	56.6	18	31.4	5	48.8	19	03.6	6	18.9	19	08.4
14	5	13.5	18	09.2	5	31.3	18	33.9	5	56.8	18	30.5	5	49.9	19	01.7	6	19.4	19	07.1
16	5	14.2	18	07.7	5	32.2	18	32.2	5	57.1	18	29.4	5	51.0	19	00.0	6	20.0	19	05.8
18	5	14.9	18	06.1	5	33.1	18	30.4	5	57.3	18	28.4	5	52.1	18	57.9	6	20.5	19	04.4
20	5	15.6	18	04.5	5	33.9	18	28.7	5	57.5	18	27.3	5	53.1	18	55.9	6	21.0	19	02.9
22	5	16.3	18	02.9	5	34.8	18	26.8	5	57.6	18	26.1	5	54.1	18	53.8	6	21.5	19	01.5
24	5	17.0	18	01.2	5	35.6	18	25.0	5	57.8	18	24.9	5	55.2	18	51.7	6	21.9	19	00.0
26	5	17.7	18	00.0	5	36.4	18	23.0	5	57.9	18	23.7	5	56.2	18	49.6	6	22.4	18	58.4
28	5	18.3	17	57.8	5	37.2	18	21.1	5	58.0	18	22.4	5	57.2	18	47.4	6	22.8	18	56.8
30	5	18.9	17	56.0	5	38.0	18	19.1	5	58.1	18	21.2	5	58.2	18	45.1	6	23.2	18	55.1
Sept. 1	5	19.6	17	54.2	5	38.8	18	17.1	5	58.2	18	19.9	5	59.2	18	42.9	6	23.6	18	53.5
3	5	20.2	17	52.3	5	39.6	18	15.0	5	58.2	18	18.5	6	00.2	18	40.6	6	24.0	18	51.8
5	5	20.8	17	50.4	5	40.4	18	13.0	5	58.3	18	17.2	6	01.1	18	38.2	6	24.4	18	50.1
7	5	21.3	17	48.5	5	41.1	18	10.9	5	58.3	18	15.8	6	02.1	18	35.9	6	24.8	18	48.3
9	5	21.9	17	46.6	5	41.9	18	08.8	5	58.3	18	14.4	6	03.0	18	33.5	6	25.1	18	46.6
11	5	22.5	17	44.6	5	42.6	18	06.7	5	58.3	18	13.0	6	04.0	18	31.1	6	25.5	18	44.8
13	5	23.1	17	42.7	5	43.4	18	04.5	5	58.3	18	11.6	6	05.0	18	28.8	6	25.8	18	43.0
15	5	23.7	17	40.7	5	44.1	18	02.4	5	58.3	18	10.2	6	05.9	18	26.4	6	26.2	18	41.2
17	5	24.2	17	38.7	5	44.9	18	00.3	5	58.4	18	08.8	6	06.9	18	24.0	6	26.5	18	39.5
19	5	24.8	17	36.7	5	45.6	17	58.1	5	58.4	18	07.4	6	07.9	18	21.5	6	26.9	18	37.7
21	5	25.4	17	34.7	5	46.3	17	56.0	5	58.4	18	05.9	6	08.8	18	19.1	6	27.2	18	35.9
23	5	26.0	17	32.7	5	47.1	17	53.8	5	58.4	18	04.5	6	09.8	18	16.8	6	27.6	18	34.1
25	5	26.6	17	30.7	5	47.9	17	51.7	5	58.4	18	03.1	6	10.8	18	14.4	6	28.0	18	32.3
27	5	27.2	17	28.7	5	48.6	17	49.6	5	58.4	18	01.8	6	11.8	18	12.0	6	28.4	18	30.5
29	5	27.8	17	26.7	5	49.4	17	47.5	5	58.5	18	00.4	6	12.8	18	09.7	6	28.7	18	28.8
Oct. 1	5	28.4	17	24.8	5	50.2	17	45.3	5	58.5	17	59.1	6	13.8	18	07.3	6	29.2	18	27.1

SUNRISE AND SUNSET, 2019
INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

Date		Kolkata 22º N 32'		Varanasi 25º N 18'		Chennai 13º N 00'		Delhi 28º N 35'		Mumbai 18º N 54'	
		Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	5 28.4	17 24.8	5 50.2	17 45.3	5 58.5	17 59.1	6 13.8	18 07.3	6 29.2	18 27.1
	3	5 29.1	17 22.8	5 51.1	17 43.3	5 58.6	17 57.7	6 14.9	18 05.0	6 29.6	18 25.4
	5	5 29.7	17 20.9	5 51.9	17 41.2	5 58.7	17 56.4	6 16.0	18 02.8	6 30.0	18 23.7
	7	5 30.4	17 19.0	5 52.7	17 39.1	5 58.8	17 55.1	6 17.0	18 00.6	6 30.5	18 22.1
	9	5 31.1	17 17.2	5 53.6	17 37.1	5 59.0	17 53.9	6 18.1	17 58.4	6 31.0	18 20.4
	11	5 31.9	17 15.4	5 54.5	17 35.2	5 59.1	17 52.7	6 19.3	17 56.2	6 31.5	18 18.9
	13	5 32.6	17 13.6	5 55.4	17 33.2	5 59.3	17 51.5	6 20.4	17 54.1	6 32.0	18 17.3
	15	5 33.4	17 11.9	5 56.4	17 31.3	6 00.0	17 50.3	6 21.6	17 52.0	6 32.6	18 15.8
	17	5 34.2	17 10.2	5 57.3	17 29.5	6 00.0	17 49.2	6 22.8	17 49.9	6 33.2	18 14.4
	19	5 35.1	17 08.5	5 58.3	17 27.7	6 00.1	17 48.1	6 24.0	17 47.9	6 33.8	18 13.0
	21	5 35.9	17 06.9	5 59.3	17 25.9	6 00.4	17 47.1	6 25.3	17 46.0	6 34.5	18 11.6
	23	5 36.8	17 05.4	6 00.4	17 24.2	6 00.7	17 46.2	6 26.6	17 44.1	6 35.2	18 10.4
	25	5 37.8	17 03.9	6 01.5	17 22.6	6 01.1	17 45.2	6 27.9	17 42.3	6 35.9	18 09.1
	27	5 38.7	17 02.5	6 02.6	17 21.0	6 01.6	17 44.4	6 29.3	17 40.5	6 36.7	18 08.0
	29	5 39.7	17 01.2	6 03.7	17 19.5	6 02.0	17 43.6	6 30.7	17 38.8	6 37.5	18 06.8
	31	5 40.7	17 00.0	6 04.9	17 18.1	6 02.5	17 42.8	6 32.1	17 37.2	6 38.3	18 05.8
Nov.	2	5 41.8	16 58.7	6 06.1	17 16.7	6 03.1	17 42.2	6 33.5	17 35.6	6 39.2	18 04.8
	4	5 42.9	16 57.6	6 07.4	17 15.4	6 03.7	17 41.6	6 35.0	17 34.2	6 40.1	18 03.9
	6	5 44.0	16 56.5	6 08.6	17 14.2	6 04.3	17 41.0	6 36.5	17 32.8	6 41.0	18 03.1
	8	5 45.2	16 55.6	6 09.9	17 13.1	6 05.0	17 40.5	6 38.0	17 31.5	6 42.0	18 02.4
	10	5 46.3	16 54.7	6 11.2	17 12.1	6 05.7	17 40.1	6 39.5	17 30.3	6 43.0	18 01.7
	12	5 47.5	16 53.9	6 12.6	17 11.2	6 06.4	17 39.8	6 41.1	17 29.2	6 44.1	18 01.1
	14	5 48.8	16 53.2	6 14.0	17 10.3	6 07.2	17 39.5	6 42.6	17 28.2	6 45.2	18 00.6
	16	5 50.0	16 52.6	6 15.3	17 09.6	6 08.1	17 39.4	6 44.2	17 27.2	6 46.3	18 00.2
	18	5 51.3	16 52.1	6 16.8	17 08.9	6 08.9	17 39.2	6 45.8	17 26.4	6 47.4	18 00.0
	20	5 52.6	16 51.6	6 18.2	17 08.4	6 09.8	17 39.2	6 47.4	17 25.7	6 48.6	18 00.0
	22	5 53.9	16 51.3	6 19.6	17 07.9	6 10.8	17 39.3	6 49.1	17 25.1	6 49.8	17 59.4
	24	5 55.2	16 51.1	6 21.1	17 07.6	6 11.7	17 39.4	6 50.7	17 24.6	6 51.0	17 59.3
	26	5 56.5	16 50.9	6 22.5	17 07.3	6 12.7	17 39.6	6 52.3	17 24.2	6 52.2	17 59.3
	28	5 57.8	16 50.9	6 24.0	17 07.2	6 13.7	17 39.8	6 53.9	17 24.0	6 53.4	17 59.3
	30	5 59.1	16 50.9	6 25.4	17 07.1	6 14.8	17 40.2	6 55.5	17 23.8	6 54.7	18 00.0
Dec.	2	6 00.5	16 51.1	6 26.8	17 07.2	6 15.9	17 40.6	6 57.0	17 23.7	6 55.9	18 00.0
	4	6 01.8	16 51.3	6 28.3	17 07.3	6 16.9	17 41.1	6 58.6	17 23.8	6 57.2	18 00.1
	6	6 03.1	16 51.7	6 29.7	17 07.6	6 18.0	17 41.6	7 00.1	17 24.0	6 58.4	18 00.5
	8	6 04.3	16 52.1	6 31.0	17 07.9	6 19.1	17 42.2	7 01.5	17 24.2	7 00.0	18 01.0
	10	6 05.6	16 52.6	6 32.4	17 08.4	6 20.2	17 42.9	7 03.0	17 24.6	7 00.9	18 01.5
	12	6 06.8	16 53.2	6 33.7	17 09.0	6 21.3	17 43.7	7 04.3	17 25.1	7 02.1	18 02.2
	14	6 08.0	16 53.9	6 34.9	17 09.6	6 22.4	17 44.4	7 05.7	17 25.7	7 03.3	18 02.9
	16	6 09.2	16 54.6	6 36.1	17 10.3	6 23.5	17 45.3	7 06.9	17 26.4	7 04.4	18 03.7
	18	6 10.3	16 55.5	6 37.3	17 11.2	6 24.5	17 46.2	7 08.1	17 27.2	7 05.5	18 04.5
	20	6 11.4	16 56.4	6 38.4	17 12.1	6 25.6	17 47.1	7 09.3	17 28.1	7 06.6	18 05.4
	22	6 12.4	16 57.4	6 39.5	17 13.0	6 26.6	17 48.1	7 10.3	17 29.0	7 07.6	18 06.4
	24	6 13.4	16 58.4	6 40.4	17 14.1	6 27.5	17 49.1	7 11.3	17 30.1	7 08.6	18 07.4
	26	6 14.3	17 00.0	6 41.3	17 15.2	6 28.5	17 50.1	7 12.2	17 31.2	7 09.5	18 08.5
	28	6 15.1	17 00.7	6 42.1	17 16.4	6 29.4	17 51.2	7 12.9	17 32.4	7 10.4	18 09.6
	30	6 15.8	17 01.9	6 42.9	17 17.6	6 30.3	17 52.3	7 13.6	17 33.7	7 11.2	18 10.7
	32	6 16.5	17 03.2	6 43.5	17 18.9	6 31.1	17 53.4	7 14.2	17 35.0	7 12.0	18 11.9

MOONRISE, 2019

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

Date \ Lat.	FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Jan. 0	1	11	1	15	1	19	1	24	1	30	1	39	0	56	1	26	1	46	1	59
1	1	58	2	06	2	14	2	23	2	34	2	50	1	52	2	18	2	43	2	53
2	2	46	2	57	3	08	3	21	3	37	4	00	2	47	3	10	3	41	3	47
3	3	34	3	48	4	02	4	18	4	39	5	07	3	42	4	01	4	38	4	40
4	4	24	4	39	4	55	5	14	5	37	6	11	4	35	4	53	5	33	5	34
5	5	14	5	30	5	47	6	08	6	33	7	09	5	28	5	45	6	26	6	25
6	6	04	6	20	6	38	6	58	7	24	8	00	6	18	6	35	7	17	7	16
7	6	53	7	09	7	25	7	45	8	09	8	43	7	06	7	23	8	04	8	03
8	7	40	7	55	8	10	8	28	8	49	9	20	7	50	8	09	8	47	8	48
9	8	26	8	39	8	52	9	07	9	25	9	50	8	31	8	52	9	26	9	30
10	9	11	9	21	9	31	9	42	9	57	10	16	9	10	9	33	10	02	10	09
11	9	54	10	01	10	08	10	16	10	26	10	39	9	46	10	12	10	36	10	47
12	10	36	10	40	10	44	10	48	10	53	11	00	10	21	10	50	11	09	11	23
13	11	19	11	19	11	19	11	20	11	20	11	21	10	56	11	29	11	42	11	59
14	12	02	11	59	11	56	11	52	11	48	11	42	11	31	12	08	12	14	12	36
15	12	48	12	41	12	34	12	27	12	17	12	04	12	08	12	48	12	49	13	15
16	13	36	13	26	13	16	13	04	12	50	12	30	12	49	13	33	13	28	13	57
17	14	28	14	16	14	02	13	47	13	28	13	02	13	34	14	21	14	11	14	43
18	15	25	15	10	14	54	14	35	14	12	13	41	14	25	15	15	15	00	15	36
19	16	25	16	09	15	51	15	31	15	06	14	31	15	22	16	13	15	56	16	33
20	17	28	17	12	16	54	16	34	16	09	15	33	16	25	17	17	16	59	17	37
21	18	32	18	17	18	01	17	42	17	19	16	46	17	32	18	21	18	07	18	43
22	19	33	19	21	19	07	18	52	18	33	18	07	18	39	19	27	19	17	19	49
23	20	31	20	22	20	13	20	02	19	48	19	30	19	46	20	29	20	25	20	54
24	21	26	21	21	21	15	21	09	21	02	20	51	20	49	21	29	21	32	21	56
25	22	18	22	17	22	15	22	14	22	12	22	10	21	51	22	25	22	36	22	56
26	23	07	23	10	23	13	23	16	23	20	23	26	22	49	23	21	23	38	23	53
27	23	56	**	**	**	**	**	**	**	**	**	**	23	47	**	**	**	**	**	**
28	**	**	0	02	0	09	0	17	0	26	0	40	**	**	0	14	0	37	0	48
29	0	44	0	53	1	04	1	16	1	30	1	51	0	42	1	06	1	36	1	43
30	1	32	1	45	1	58	2	13	2	32	2	59	1	38	1	58	2	33	2	37
31	2	21	2	36	2	51	3	09	3	32	4	04	2	31	2	50	3	29	3	30
Feb. 1	3	10	3	26	3	44	4	03	4	28	5	03	3	25	3	41	4	22	4	22
2	4	00	4	16	4	34	4	55	5	20	5	56	4	15	4	31	5	14	5	12
3	4	49	5	05	5	22	5	42	6	07	6	42	5	03	5	20	6	01	6	00
4	5	37	5	52	6	08	6	26	6	49	7	21	5	48	6	06	6	45	6	46
5	6	24	6	37	6	50	7	06	7	26	7	53	6	30	6	50	7	26	7	29
6	7	08	7	19	7	30	7	43	7	59	8	20	7	10	7	32	8	03	8	09
7	7	52	8	00	8	08	8	17	8	29	8	44	7	47	8	12	8	37	8	47
8	8	35	8	39	8	44	8	50	8	57	9	06	8	21	8	50	9	11	9	24
9	9	17	9	18	9	20	9	21	9	23	9	26	8	56	9	28	9	43	9	59
10	9	59	9	57	9	55	9	53	9	50	9	46	9	31	10	06	10	15	10	35
11	10	43	10	38	10	32	10	26	10	18	10	08	10	06	10	45	10	48	11	12
12	11	29	11	20	11	11	11	01	10	48	10	31	10	44	11	27	11	24	11	52
13	12	18	12	06	11	54	11	40	11	23	10	59	11	26	12	12	12	03	12	35
14	13	10	12	56	12	41	12	24	12	02	11	33	12	12	13	01	12	48	13	23
15	14	07	13	51	13	34	13	14	12	50	12	16	13	05	13	55	13	39	14	16

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2019
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Jan.	0	13	34	13	28	13	22	13	15	13	06	12	55	12	56	13	36	13	38	14	02
	1	14	21	14	12	14	02	13	52	13	38	13	20	13	36	14	19	14	15	14	43
	2	15	09	14	57	14	45	14	30	14	12	13	48	14	17	15	03	14	54	15	26
	3	15	58	15	44	15	29	15	11	14	50	14	20	15	00	15	49	15	36	16	10
	4	16	48	16	32	16	15	15	56	15	32	14	58	15	47	16	36	16	20	16	57
	5	17	38	17	21	17	04	16	43	16	18	15	42	16	34	17	26	17	08	17	46
	6	18	28	18	11	17	54	17	34	17	08	16	33	17	25	18	15	17	58	18	35
	7	19	16	19	01	18	44	18	26	18	02	17	29	18	15	19	05	18	50	19	26
	8	20	03	19	49	19	35	19	19	18	58	18	29	19	07	19	55	19	43	20	16
	9	20	48	20	37	20	25	20	12	19	55	19	31	19	58	20	43	20	35	21	06
	10	21	32	21	24	21	15	21	05	20	52	20	35	20	48	21	30	21	28	21	55
	11	22	14	22	09	22	04	21	57	21	49	21	39	21	38	22	17	22	20	22	44
	12	22	57	22	55	22	53	22	50	22	47	22	43	22	27	23	03	23	12	23	33
	13	23	39	23	41	23	42	23	44	23	46	23	49	23	18	23	51	**	**	**	**
	14	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	05	0	22
	15	0	24	0	28	0	34	0	39	0	47	0	56	0	10	0	39	1	00	1	13
	16	1	10	1	18	1	27	1	37	1	50	2	07	1	05	1	31	1	58	2	06
	17	2	00	2	12	2	24	2	38	2	55	3	19	2	03	2	25	2	58	3	03
	18	2	55	3	09	3	24	3	41	4	03	4	33	3	04	3	23	4	01	4	02
	19	3	53	4	09	4	26	4	46	5	11	5	45	4	07	4	24	5	05	5	05
	20	4	55	5	12	5	30	5	50	6	16	6	52	5	10	5	27	6	09	6	08
	21	5	59	6	15	6	32	6	51	7	15	7	49	6	12	6	29	7	10	7	10
	22	7	01	7	15	7	30	7	46	8	07	8	36	7	10	7	29	8	06	8	08
	23	8	01	8	12	8	23	8	36	8	52	9	13	8	02	8	25	8	56	9	02
	24	8	58	9	05	9	12	9	20	9	31	9	44	8	50	9	17	9	41	9	51
	25	9	51	9	54	9	57	10	01	10	05	10	11	9	34	10	04	10	22	10	37
	26	10	41	10	41	10	40	10	39	10	38	10	36	10	15	10	50	11	01	11	20
	27	11	30	11	26	11	21	11	16	11	09	11	00	10	56	11	34	11	38	12	01
	28	12	19	12	11	12	02	11	53	11	41	11	25	11	36	12	18	12	16	12	43
	29	13	07	12	56	12	44	12	31	12	14	11	52	12	17	13	02	12	54	13	26
	30	13	56	13	42	13	28	13	11	12	51	12	22	13	00	13	48	13	36	14	09
	31	14	45	14	29	14	13	13	54	13	31	12	58	13	45	14	34	14	19	14	55
Feb.	1	15	34	15	18	15	00	14	40	14	15	13	39	14	31	15	23	15	05	15	43
	2	16	24	16	07	15	50	15	29	15	04	14	28	15	21	16	11	15	54	16	31
	3	17	12	16	57	16	40	16	21	15	56	15	22	16	11	17	01	16	45	17	22
	4	18	00	17	46	17	31	17	13	16	51	16	21	17	02	17	51	17	38	18	12
	5	18	45	18	34	18	21	18	06	17	48	17	23	17	53	18	39	18	30	19	02
	6	19	30	19	21	19	11	18	59	18	45	18	26	18	43	19	27	19	23	19	52
	7	20	13	20	06	20	00	19	52	19	43	19	30	19	34	20	14	20	15	20	40
	8	20	55	20	52	20	49	20	45	20	40	20	34	20	23	21	00	21	07	21	29
	9	21	37	21	37	21	38	21	38	21	38	21	39	21	13	21	47	22	00	22	17
	10	22	20	22	24	22	27	22	32	22	37	22	45	22	04	22	34	22	53	23	07
	11	23	05	23	11	23	19	23	27	23	38	23	52	22	56	23	23	23	48	23	58
	12	23	52	**	**	**	**	**	**	**	**	**	**	23	51	**	**	**	**	**	**
	13	**	**	0	02	0	13	0	25	0	40	1	02	**	**	0	14	0	45	0	51
	14	0	42	0	55	1	09	1	25	1	45	2	13	0	48	1	09	1	45	1	48
	15	1	37	1	52	2	08	2	27	2	50	3	23	1	48	2	06	2	46	2	46

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2019
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Feb.	15	14	07	13	51	13	34	13	14	12	50	12	16	13	05	13	55	13	39	14	16
	16	15	07	14	50	14	32	14	12	13	46	13	10	14	03	14	54	14	37	15	15
	17	16	09	15	53	15	36	15	16	14	51	14	16	15	07	15	58	15	41	16	18
	18	17	11	16	57	16	42	16	25	16	03	15	33	16	13	17	02	16	49	17	24
	19	18	11	18	00	17	49	17	35	17	19	16	56	17	21	18	07	18	00	18	30
	20	19	09	19	02	18	54	18	45	18	35	18	20	18	27	19	09	19	09	19	36
	21	20	04	20	01	19	58	19	54	19	49	19	43	19	32	20	09	20	16	20	38
	22	20	56	20	57	20	58	21	00	21	01	21	04	20	34	21	07	21	22	21	39
	23	21	47	21	52	21	58	22	04	22	11	22	21	21	35	22	03	22	24	22	37
	24	22	37	22	46	22	55	23	05	23	18	23	36	22	33	22	58	23	26	23	34
	25	23	27	23	39	23	51	**	**	**	**	**	**	23	31	23	52	**	**	**	**
	26	**	**	**	**	**	**	0	05	0	23	0	48	**	**	**	**	0	25	0	30
	27	0	17	0	31	0	46	1	03	1	25	1	56	0	26	0	45	1	23	1	25
	28	1	07	1	22	1	39	1	59	2	23	2	58	1	20	1	37	2	18	2	18
Mar.	1	1	57	2	13	2	31	2	51	3	17	3	53	2	12	2	28	3	10	3	09
	2	2	46	3	02	3	20	3	40	4	05	4	41	3	01	3	17	3	59	3	58
	3	3	34	3	49	4	06	4	25	4	49	5	22	3	47	4	04	4	44	4	44
	4	4	21	4	35	4	49	5	06	5	27	5	56	4	29	4	48	5	26	5	28
	5	5	06	5	18	5	30	5	44	6	01	6	24	5	09	5	31	6	03	6	08
	6	5	50	5	59	6	08	6	19	6	32	6	49	5	47	6	11	6	39	6	47
	7	6	33	6	39	6	45	6	52	7	00	7	11	6	22	6	50	7	13	7	24
	8	7	16	7	18	7	21	7	23	7	27	7	32	6	57	7	29	7	45	8	00
	9	7	58	7	57	7	56	7	55	7	54	7	52	7	32	8	06	8	17	8	36
	10	8	41	8	37	8	33	8	27	8	21	8	13	8	07	8	45	8	50	9	13
	11	9	26	9	19	9	11	9	01	8	50	8	35	8	44	9	26	9	25	9	51
	12	10	13	10	03	9	51	9	38	9	22	9	01	9	24	10	09	10	02	10	32
	13	11	04	10	50	10	36	10	20	9	59	9	32	10	08	10	55	10	44	11	17
	14	11	57	11	42	11	25	11	06	10	43	10	10	10	56	11	46	11	31	12	07
	15	12	54	12	37	12	19	11	59	11	33	10	57	11	50	12	41	12	24	13	01
	16	13	53	13	36	13	18	12	58	12	32	11	56	12	49	13	41	13	23	14	01
	17	14	53	14	38	14	21	14	03	13	39	13	06	13	53	14	42	14	27	15	04
	18	15	52	15	40	15	26	15	10	14	51	14	24	14	58	15	46	15	35	16	08
	19	16	50	16	41	16	31	16	20	16	06	15	46	16	04	16	48	16	44	17	13
	20	17	46	17	41	17	35	17	29	17	21	17	10	17	09	17	49	17	52	18	16
	21	18	40	18	39	18	38	18	36	18	35	18	33	18	13	18	48	18	59	19	18
	22	19	33	19	36	19	39	19	43	19	47	19	54	19	16	19	46	20	04	20	19
	23	20	24	20	31	20	39	20	47	20	58	21	13	20	16	20	43	21	08	21	18
	24	21	16	21	26	21	38	21	51	22	07	22	29	21	17	21	40	22	10	22	16
	25	22	08	22	21	22	35	22	52	23	12	23	41	22	15	22	34	23	11	23	14
	26	22	59	23	14	23	31	23	50	**	**	**	**	23	11	23	29	**	**	**	**
	27	23	50	**	**	**	**	**	**	0	14	0	48	**	**	**	**	0	09	0	09
	28	**	**	0	07	0	25	0	45	1	11	1	47	0	05	0	21	1	04	1	03
	29	0	41	0	57	1	15	1	36	2	02	2	39	0	56	1	12	1	55	1	54
	30	1	30	1	46	2	03	2	23	2	47	3	22	1	44	2	00	2	41	2	41
	31	2	17	2	32	2	47	3	05	3	27	3	58	2	27	2	46	3	25	3	26
Apr.	1	3	03	3	16	3	29	3	44	4	03	4	28	3	09	3	29	4	03	4	07
	2	3	48	3	57	4	08	4	20	4	34	4	54	3	47	4	10	4	39	4	46

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2019
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Feb.	15	1	37	1	52	2	08	2	27	2	50	3	23	1	48	2	06	2	46	2	46
	16	2	35	2	51	3	09	3	29	3	55	4	31	2	50	3	06	3	49	3	48
	17	3	36	3	53	4	10	4	30	4	56	5	31	3	51	4	08	4	50	4	49
	18	4	38	4	54	5	10	5	28	5	51	6	23	4	50	5	08	5	48	5	49
	19	5	40	5	52	6	06	6	21	6	39	7	05	5	46	6	06	6	41	6	45
	20	6	39	6	48	6	58	7	08	7	22	7	40	6	36	7	01	7	29	7	37
	21	7	35	7	40	7	46	7	52	7	59	8	09	7	24	7	52	8	13	8	25
	22	8	29	8	30	8	31	8	32	8	34	8	36	8	07	8	40	8	54	9	11
	23	9	21	9	18	9	15	9	11	9	06	9	01	8	50	9	27	9	33	9	55
	24	10	11	10	04	9	57	9	49	9	39	9	26	9	32	10	12	10	12	10	38
	25	11	01	10	51	10	40	10	28	10	13	9	53	10	13	10	57	10	52	11	22
	26	11	51	11	38	11	24	11	09	10	49	10	23	10	56	11	44	11	33	12	06
	27	12	41	12	26	12	10	11	52	11	29	10	57	11	42	12	31	12	16	12	52
	28	13	31	13	15	12	57	12	37	12	12	11	37	12	28	13	19	13	02	13	39
Mar.	1	14	20	14	04	13	46	13	26	13	00	12	23	13	17	14	08	13	51	14	28
	2	15	09	14	53	14	36	14	16	13	51	13	16	14	07	14	58	14	41	15	18
	3	15	57	15	42	15	26	15	08	14	45	14	13	14	58	15	47	15	33	16	08
	4	16	43	16	30	16	17	16	01	15	42	15	14	15	49	16	35	16	25	16	58
	5	17	28	17	18	17	07	16	54	16	39	16	17	16	39	17	24	17	18	17	48
	6	18	11	18	04	17	56	17	47	17	37	17	21	17	30	18	11	18	10	18	37
	7	18	54	18	50	18	45	18	41	18	34	18	26	18	20	18	58	19	03	19	26
	8	19	36	19	35	19	35	19	34	19	33	19	31	19	10	19	45	19	56	20	14
	9	20	19	20	22	20	24	20	28	20	32	20	37	20	01	20	32	20	49	21	04
	10	21	03	21	09	21	15	21	23	21	32	21	44	20	53	21	20	21	43	21	54
	11	21	49	21	58	22	08	22	19	22	33	22	53	21	46	22	10	22	39	22	46
	12	22	37	22	49	23	02	23	17	23	36	**	**	22	41	23	02	23	37	23	41
	13	23	29	23	43	23	59	**	**	**	**	0	02	23	39	23	57	**	**	**	**
	14	**	**	**	**	**	**	0	17	0	40	1	11	**	**	**	**	0	36	0	37
	15	0	24	0	40	0	58	1	18	1	43	2	18	0	38	0	55	1	37	1	36
	16	1	22	1	39	1	56	2	17	2	43	3	19	1	37	1	53	2	36	2	34
	17	2	21	2	37	2	55	3	14	3	39	4	13	2	35	2	52	3	33	3	33
	18	3	21	3	35	3	50	4	07	4	28	4	57	3	31	3	50	4	27	4	29
	19	4	20	4	31	4	43	4	56	5	12	5	34	4	22	4	44	5	16	5	22
	20	5	17	5	24	5	32	5	41	5	51	6	05	5	10	5	37	6	01	6	11
	21	6	12	6	15	6	18	6	22	6	27	6	33	5	56	6	26	6	44	6	58
	22	7	05	7	04	7	03	7	02	7	00	6	58	6	39	7	14	7	24	7	44
	23	7	57	7	52	7	47	7	41	7	34	7	24	7	22	8	00	8	04	8	27
	24	8	49	8	40	8	31	8	21	8	08	7	50	8	05	8	47	8	44	9	12
	25	9	41	9	29	9	16	9	02	8	44	8	19	8	48	9	35	9	26	9	58
	26	10	32	10	18	10	03	9	45	9	23	8	53	9	34	10	23	10	09	10	44
	27	11	24	11	08	10	51	10	31	10	06	9	31	10	21	11	12	10	56	11	33
	28	12	15	11	58	11	40	11	19	10	53	10	16	11	11	12	02	11	44	12	22
	29	13	05	12	48	12	30	12	10	11	44	11	08	12	01	12	52	12	34	13	12
	30	13	53	13	38	13	21	13	02	12	38	12	04	12	52	13	42	13	27	14	03
	31	14	40	14	26	14	12	13	55	13	34	13	04	13	43	14	31	14	19	14	53
Apr.	1	15	25	15	14	15	02	14	48	14	31	14	07	14	34	15	20	15	12	15	43
	2	16	09	16	00	15	51	15	41	15	29	15	11	15	25	16	07	16	04	16	32

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2019
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

Date \ Lat.	FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Apr. 1	3	03	3	16	3	29	3	44	4	03	4	28	3	09	3	29	4	03	4	07
2	3	48	3	57	4	08	4	20	4	34	4	54	3	47	4	10	4	39	4	46
3	4	31	4	38	4	45	4	53	5	03	5	16	4	23	4	49	5	14	5	24
4	5	14	5	17	5	21	5	25	5	30	5	37	4	58	5	28	5	46	6	00
5	5	56	5	56	5	57	5	57	5	57	5	57	5	33	6	06	6	18	6	36
6	6	40	6	36	6	33	6	29	6	24	6	18	6	08	6	45	6	51	7	13
7	7	24	7	18	7	11	7	02	6	53	6	39	6	45	7	25	7	26	7	51
8	8	11	8	01	7	51	7	39	7	24	7	04	7	24	8	08	8	02	8	31
9	9	01	8	48	8	34	8	19	7	59	7	33	8	06	8	53	8	43	9	16
10	9	53	9	38	9	22	9	03	8	40	8	08	8	53	9	43	9	28	10	04
11	10	48	10	32	10	14	9	54	9	28	8	52	9	45	10	36	10	18	10	56
12	11	46	11	29	11	11	10	50	10	23	9	46	10	41	11	33	11	15	11	53
13	12	44	12	28	12	11	11	51	11	26	10	51	11	42	12	32	12	15	12	53
14	13	41	13	28	13	13	12	55	12	34	12	04	12	44	13	33	13	20	13	55
15	14	38	14	27	14	15	14	02	13	45	13	22	13	48	14	33	14	26	14	57
16	15	33	15	25	15	18	15	09	14	58	14	43	14	51	15	33	15	33	15	59
17	16	26	16	23	16	19	16	15	16	11	16	04	15	54	16	31	16	38	17	00
18	17	18	17	19	17	20	17	21	17	23	17	25	16	56	17	29	17	44	18	00
19	18	10	18	15	18	20	18	27	18	34	18	45	17	58	18	26	18	48	19	00
20	19	02	19	11	19	20	19	31	19	45	20	03	18	58	19	23	19	52	19	59
21	19	54	20	06	20	19	20	34	20	53	21	19	19	59	20	19	20	54	20	58
22	20	47	21	02	21	17	21	36	21	58	22	31	20	57	21	16	21	55	21	56
23	21	40	21	56	22	14	22	34	22	59	23	36	21	54	22	11	22	53	22	52
24	22	32	22	49	23	07	23	28	23	55	**	**	22	48	23	04	23	47	23	45
25	23	23	23	39	23	57	**	**	**	**	0	32	23	38	23	54	**	**	**	**
26	**	**	**	**	**	**	0	18	0	43	1	20	**	**	**	**	0	36	0	35
27	0	11	0	27	0	43	1	02	1	26	1	59	0	24	0	41	1	22	1	22
28	0	58	1	12	1	26	1	43	2	03	2	31	1	06	1	26	2	02	2	04
29	1	44	1	54	2	06	2	19	2	36	2	58	1	46	2	07	2	39	2	45
30	2	27	2	35	2	44	2	53	3	05	3	22	2	22	2	47	3	14	3	23
May 1	3	10	3	15	3	20	3	26	3	33	3	43	2	57	3	26	3	47	3	59
2	3	52	3	54	3	55	3	57	3	59	4	03	3	32	4	04	4	18	4	35
3	4	35	4	33	4	31	4	29	4	26	4	22	4	07	4	42	4	51	5	11
4	5	20	5	14	5	09	5	02	4	54	4	43	4	43	5	22	5	25	5	49
5	6	06	5	58	5	48	5	38	5	24	5	07	5	22	6	04	6	01	6	29
6	6	56	6	44	6	31	6	17	5	59	5	34	6	03	6	49	6	40	7	12
7	7	48	7	34	7	18	7	00	6	38	6	07	6	49	7	39	7	25	8	00
8	8	44	8	27	8	10	7	49	7	24	6	49	7	41	8	31	8	14	8	52
9	9	41	9	24	9	05	8	44	8	18	7	40	8	36	9	28	9	10	9	48
10	10	39	10	23	10	05	9	44	9	18	8	42	9	36	10	27	10	09	10	47
11	11	37	11	22	11	06	10	48	10	25	9	52	10	37	11	27	11	13	11	48
12	12	33	12	21	12	08	11	53	11	34	11	08	11	40	12	26	12	17	12	49
13	13	27	13	18	13	09	12	58	12	45	12	27	12	42	13	25	13	22	13	50
14	14	19	14	14	14	09	14	03	13	56	13	46	13	43	14	22	14	25	14	49
15	15	10	15	09	15	08	15	07	15	06	15	04	14	43	15	18	15	29	15	48
16	16	00	16	03	16	07	16	11	16	16	16	23	15	43	16	14	16	32	16	46
17	16	51	16	58	17	05	17	14	17	25	17	40	16	43	17	10	17	35	17	45

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2019

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

Date		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Apr.	1	15	25	15	14	15	02	14	48	14	31	14	07	14	34	15	20	15	12	15	43
	2	16	09	16	00	15	51	15	41	15	29	15	11	15	25	16	07	16	04	16	32
	3	16	52	16	46	16	41	16	35	16	27	16	16	16	15	16	54	16	57	17	21
	4	17	34	17	32	17	30	17	28	17	25	17	21	17	05	17	41	17	50	18	10
	5	18	17	18	19	18	20	18	22	18	25	18	28	17	56	18	28	18	43	19	00
	6	19	01	19	06	19	11	19	17	19	25	19	35	18	48	19	17	19	39	19	51
	7	19	47	19	55	20	04	20	14	20	27	20	44	19	42	20	07	20	34	20	43
	8	20	35	20	46	20	58	21	12	21	30	21	54	20	37	20	59	21	32	21	37
	9	21	25	21	40	21	55	22	12	22	34	23	05	21	35	21	54	22	31	22	33
	10	22	19	22	35	22	53	23	12	23	37	**	**	22	33	22	50	23	31	23	31
	11	23	16	23	33	23	51	**	**	**	**	0	12	23	31	23	47	**	**	**	**
	12	**	**	**	**	**	**	0	11	0	38	1	15	**	**	**	**	0	30	0	28
	13	0	13	0	30	0	48	1	08	1	34	2	09	0	28	0	45	1	27	1	26
	14	1	11	1	26	1	43	2	01	2	24	2	55	1	23	1	41	2	20	2	21
	15	2	09	2	21	2	34	2	49	3	08	3	33	2	14	2	34	3	09	3	13
	16	3	04	3	13	3	23	3	34	3	47	4	05	3	02	3	26	3	54	4	02
	17	3	58	4	03	4	09	4	15	4	23	4	33	3	47	4	15	4	36	4	48
	18	4	51	4	52	4	53	4	54	4	56	4	58	4	29	5	02	5	16	5	33
	19	5	43	5	40	5	37	5	33	5	28	5	22	5	12	5	49	5	55	6	17
	20	6	35	6	28	6	20	6	12	6	02	5	48	5	54	6	35	6	35	7	01
	21	7	27	7	16	7	05	6	52	6	37	6	15	6	38	7	23	7	16	7	47
	22	8	19	8	06	7	52	7	35	7	15	6	47	7	24	8	11	8	00	8	33
	23	9	12	8	57	8	40	8	21	7	57	7	23	8	11	9	01	8	45	9	22
	24	10	05	9	48	9	30	9	09	8	43	8	07	9	01	9	52	9	35	10	12
	25	10	56	10	39	10	21	10	00	9	34	8	56	9	52	10	43	10	25	11	03
	26	11	46	11	30	11	13	10	53	10	28	9	52	10	43	11	35	11	18	11	55
	27	12	34	12	20	12	04	11	46	11	24	10	52	11	36	12	24	12	10	12	46
	28	13	20	13	08	12	55	12	40	12	21	11	54	12	27	13	14	13	04	13	36
	29	14	05	13	55	13	45	13	33	13	18	12	58	13	18	14	01	13	57	14	26
	30	14	48	14	41	14	34	14	26	14	16	14	03	14	08	14	48	14	49	15	15
May	1	15	30	15	27	15	24	15	20	15	15	15	08	14	58	15	36	15	42	16	04
	2	16	13	16	13	16	13	16	14	16	14	16	14	15	49	16	22	16	35	16	53
	3	16	56	17	00	17	04	17	09	17	14	17	22	16	41	17	11	17	30	17	44
	4	17	42	17	49	17	57	18	06	18	16	18	31	17	35	18	01	18	26	18	36
	5	18	30	18	40	18	51	19	04	19	20	19	43	18	30	18	53	19	24	19	30
	6	19	21	19	34	19	48	20	05	20	26	20	54	19	28	19	48	20	24	20	27
	7	20	14	20	30	20	47	21	06	21	31	22	05	20	27	20	44	21	26	21	25
	8	21	11	21	28	21	46	22	07	22	33	23	11	21	27	21	43	22	26	22	24
	9	22	09	22	26	22	44	23	05	23	31	**	**	22	25	22	41	23	24	23	23
	10	23	07	23	23	23	40	23	59	**	**	0	08	23	20	23	38	**	**	**	**
	11	**	**	**	**	**	**	**	**	0	23	0	57	**	**	**	**	0	18	0	18
	12	0	04	0	17	0	32	0	48	1	09	1	37	0	12	0	31	1	08	1	10
	13	0	59	1	09	1	20	1	33	1	48	2	09	0	59	1	22	1	53	1	59
	14	1	52	1	58	2	06	2	14	2	24	2	37	1	44	2	10	2	34	2	45
	15	2	43	2	46	2	49	2	52	2	56	3	02	2	25	2	56	3	14	3	29
	16	3	34	3	32	3	31	3	29	3	28	3	25	3	07	3	42	3	52	4	11
	17	4	24	4	19	4	13	4	07	3	59	3	49	3	48	4	26	4	29	4	54

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2019
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
May	17	16	51	16	58	17	05	17	14	17	25	17	40	16	43	17	10	17	35	17	45
	18	17	42	17	53	18	04	18	17	18	34	18	57	17	43	18	05	18	37	18	43
	19	18	34	18	48	19	03	19	20	19	41	20	10	18	42	19	02	19	39	19	42
	20	19	27	19	43	20	00	20	20	20	45	21	19	19	41	19	58	20	39	20	38
	21	20	20	20	38	20	56	21	17	21	43	22	21	20	36	20	52	21	36	21	34
	22	21	13	21	30	21	48	22	09	22	36	23	14	21	29	21	45	22	28	22	26
	23	22	03	22	20	22	37	22	57	23	22	23	57	22	17	22	34	23	16	23	15
	24	22	52	23	06	23	22	23	40	**	**	**	**	23	02	23	21	23	59	24	00
	25	23	38	23	50	**	**	**	**	0	02	0	32	23	43	**	**	**	**	**	**
	26	**	**	**	**	0	03	0	18	0	36	1	01	**	**	0	03	0	37	0	41
	27	0	22	0	32	0	42	0	53	1	07	1	26	0	20	0	44	1	13	1	20
	28	1	05	1	11	1	18	1	26	1	35	1	48	0	56	1	23	1	47	1	57
	29	1	47	1	50	1	53	1	57	2	02	2	08	1	31	2	01	2	18	2	33
	30	2	30	2	29	2	29	2	28	2	28	2	27	2	05	2	38	2	50	3	09
	31	3	13	3	09	3	05	3	00	2	55	2	47	2	40	3	18	3	23	3	45
June	1	3	59	3	51	3	43	3	34	3	24	3	09	3	17	3	58	3	58	4	24
	2	4	47	4	36	4	25	4	12	3	56	3	35	3	58	4	42	4	35	5	06
	3	5	39	5	25	5	11	4	54	4	33	4	05	4	42	5	31	5	18	5	52
	4	6	34	6	18	6	01	5	42	5	18	4	44	5	32	6	22	6	06	6	43
	5	7	32	7	15	6	57	6	36	6	09	5	32	6	27	7	20	7	01	7	39
	6	8	32	8	15	7	57	7	36	7	09	6	31	7	27	8	19	8	01	8	39
	7	9	31	9	16	8	59	8	40	8	15	7	41	8	30	9	21	9	05	9	41
	8	10	29	10	16	10	02	9	45	9	25	8	57	9	34	10	21	10	10	10	43
	9	11	24	11	14	11	03	10	51	10	36	10	15	10	36	11	21	11	15	11	45
	10	12	16	12	10	12	03	11	56	11	47	11	34	11	38	12	17	12	19	12	44
	11	13	07	13	04	13	02	12	59	12	56	12	52	12	37	13	13	13	22	13	43
	12	13	56	13	58	14	00	14	02	14	05	14	09	13	36	14	08	14	23	14	39
	13	14	45	14	51	14	57	15	04	15	13	15	25	14	34	15	02	15	25	15	37
	14	15	35	15	44	15	54	16	06	16	20	16	40	15	33	15	57	16	26	16	33
	15	16	26	16	38	16	52	17	07	17	27	17	54	16	31	16	52	17	27	17	31
	16	17	18	17	33	17	49	18	08	18	31	19	04	17	29	17	47	18	27	18	27
	17	18	10	18	27	18	45	19	06	19	32	20	09	18	26	18	42	19	25	19	24
	18	19	03	19	20	19	39	20	00	20	27	21	05	19	20	19	36	20	19	20	17
	19	19	55	20	12	20	29	20	50	21	16	21	53	20	10	20	26	21	09	21	08
	20	20	44	21	00	21	16	21	35	21	59	22	32	20	57	21	14	21	54	21	55
	21	21	32	21	45	21	59	22	16	22	36	23	03	21	39	21	59	22	35	22	37
	22	22	17	22	28	22	39	22	52	23	08	23	30	22	18	22	40	23	12	23	18
	23	23	00	23	08	23	16	23	25	23	37	23	52	22	55	23	20	23	46	23	55
	24	23	42	23	47	23	52	23	57	**	**	**	**	23	29	23	58	**	**	**	**
	25	**	**	**	**	**	**	**	**	0	04	0	12	**	**	**	**	0	18	0	31
	26	0	24	0	25	0	26	0	28	0	29	0	32	0	03	0	35	0	49	1	06
	27	1	06	1	04	1	02	0	59	0	56	0	51	0	37	1	13	1	21	1	42
	28	1	50	1	44	1	38	1	31	1	23	1	12	1	13	1	52	1	54	2	19
	29	2	36	2	27	2	18	2	07	1	53	1	35	1	51	2	34	2	30	2	59
	30	3	26	3	14	3	01	2	46	2	28	2	02	2	33	3	20	3	10	3	42
July	1	4	20	4	05	3	49	3	31	3	08	2	37	3	21	4	10	3	56	4	31
	2	5	18	5	01	4	43	4	22	3	57	3	21	4	13	5	05	4	47	5	25

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2019
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONSET (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
May	17	4	24	4	19	4	13	4	07	3	59	3	49	3	48	4	26	4	29	4	54
	18	5	15	5	06	4	56	4	46	4	32	4	14	4	30	5	13	5	09	5	38
	19	6	07	5	55	5	42	5	27	5	08	4	43	5	14	6	00	5	51	6	23
	20	7	00	6	45	6	29	6	11	5	48	5	17	6	01	6	50	6	35	7	11
	21	7	53	7	36	7	19	6	58	6	33	5	57	6	50	7	41	7	24	8	01
	22	8	46	8	29	8	10	7	49	7	22	6	44	7	41	8	33	8	14	8	52
	23	9	37	9	21	9	03	8	42	8	15	7	38	8	33	9	25	9	07	9	45
	24	10	27	10	11	9	55	9	36	9	11	8	37	9	26	10	16	10	00	10	36
	25	11	14	11	01	10	46	10	30	10	09	9	40	10	18	11	06	10	54	11	28
	26	12	00	11	49	11	37	11	23	11	07	10	44	11	09	11	55	11	47	12	18
	27	12	43	12	35	12	27	12	17	12	05	11	48	12	00	12	42	12	40	13	07
	28	13	25	13	21	13	16	13	10	13	03	12	53	12	50	13	29	13	33	13	56
	29	14	07	14	06	14	05	14	03	14	01	13	58	13	40	14	15	14	25	14	45
	30	14	50	14	52	14	55	14	57	15	00	15	05	14	31	15	03	15	19	15	35
	31	15	35	15	40	15	46	15	53	16	02	16	13	15	24	15	52	16	14	16	25
June	1	16	21	16	30	16	40	16	51	17	05	17	24	16	18	16	43	17	12	17	19
	2	17	11	17	24	17	37	17	52	18	11	18	37	17	16	17	37	18	11	18	15
	3	18	05	18	20	18	36	18	54	19	17	19	50	18	15	18	34	19	13	19	14
	4	19	02	19	18	19	36	19	57	20	23	21	00	19	17	19	33	20	16	20	14
	5	20	01	20	18	20	37	20	58	21	25	22	02	20	17	20	33	21	17	21	15
	6	21	01	21	17	21	35	21	55	22	20	22	56	21	16	21	32	22	14	22	13
	7	21	59	22	14	22	29	22	47	23	09	23	39	22	09	22	28	23	06	23	08
	8	22	55	23	07	23	19	23	33	23	50	**	**	22	59	23	21	23	53	23	58
	9	23	49	23	57	**	**	**	**	**	**	0	14	23	44	**	**	**	**	**	**
	10	**	**	**	**	0	06	0	15	0	27	0	43	**	**	0	09	0	35	0	45
	11	0	40	0	44	0	49	0	54	1	00	1	08	0	26	0	55	1	15	1	29
	12	1	30	1	30	1	30	1	31	1	31	1	31	1	07	1	40	1	52	2	10
	13	2	19	2	15	2	11	2	07	2	01	1	54	1	47	2	24	2	29	2	52
	14	3	09	3	01	2	53	2	44	2	33	2	18	2	27	3	08	3	07	3	34
	15	3	59	3	48	3	36	3	23	3	07	2	44	3	09	3	54	3	47	4	17
	16	4	51	4	37	4	22	4	05	3	44	3	15	3	54	4	42	4	29	5	04
	17	5	43	5	27	5	10	4	50	4	26	3	52	4	41	5	32	5	15	5	52
	18	6	36	6	19	6	00	5	39	5	13	4	35	5	32	6	23	6	04	6	42
	19	7	28	7	11	6	53	6	31	6	05	5	26	6	23	7	15	6	56	7	35
	20	8	19	8	03	7	45	7	25	7	00	6	24	7	16	8	07	7	50	8	27
	21	9	08	8	53	8	38	8	20	7	57	7	26	8	09	8	58	8	44	9	19
	22	9	54	9	42	9	29	9	14	8	55	8	29	9	01	9	47	9	38	10	10
	23	10	38	10	29	10	19	10	07	9	53	9	34	9	52	10	35	10	31	11	00
	24	11	21	11	15	11	08	11	00	10	51	10	38	10	42	11	22	11	23	11	49
	25	12	02	12	00	11	57	11	53	11	49	11	43	11	32	12	08	12	15	12	37
	26	12	44	12	45	12	45	12	46	12	47	12	48	12	21	12	54	13	08	13	26
	27	13	27	13	31	13	36	13	40	13	47	13	55	13	13	13	42	14	02	14	15
	28	14	12	14	20	14	28	14	37	14	48	15	04	14	05	14	31	14	57	15	07
	29	15	00	15	11	15	22	15	36	15	52	16	15	15	01	15	24	15	56	16	01
	30	15	52	16	05	16	20	16	37	16	58	17	28	16	00	16	19	16	56	16	58
July	1	16	47	17	03	17	20	17	40	18	05	18	40	17	01	17	18	17	59	17	59
	2	17	46	18	03	18	22	18	43	19	10	19	48	18	02	18	18	19	02	19	00

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2019

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONRISE (MOON'S UPPER LIMB)

	FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date \ Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
July 1	4	20	4	05	3	49	3	31	3	08	2	37	3	21	4	10	3	56	4	31
2	5	18	5	01	4	43	4	22	3	57	3	21	4	13	5	05	4	47	5	25
3	6	18	6	01	5	42	5	21	4	54	4	16	5	13	6	05	5	46	6	24
4	7	19	7	03	6	45	6	25	5	59	5	23	6	16	7	07	6	50	7	28
5	8	20	8	05	7	50	7	32	7	10	6	39	7	21	8	10	7	57	8	32
6	9	17	9	06	8	54	8	40	8	23	8	00	8	26	9	12	9	05	9	36
7	10	12	10	05	9	57	9	47	9	36	9	21	9	30	10	12	10	11	10	38
8	11	04	11	00	10	57	10	53	10	47	10	40	10	31	11	09	11	15	11	38
9	11	54	11	54	11	55	11	56	11	57	11	58	11	31	12	04	12	18	12	35
10	12	43	12	48	12	52	12	58	13	05	13	14	12	29	12	58	13	19	13	32
11	13	32	13	40	13	49	13	59	14	12	14	29	13	27	13	53	14	20	14	28
12	14	22	14	33	14	46	15	00	15	18	15	43	14	25	14	46	15	20	15	25
13	15	12	15	27	15	42	16	00	16	22	16	53	15	22	15	41	16	19	16	20
14	16	04	16	20	16	38	16	58	17	23	17	59	16	18	16	35	17	17	17	16
15	16	56	17	13	17	32	17	53	18	20	18	58	17	13	17	29	18	12	18	10
16	17	48	18	05	18	23	18	44	19	11	19	48	18	04	18	20	19	03	19	01
17	18	38	18	54	19	11	19	31	19	56	20	30	18	52	19	09	19	50	19	50
18	19	26	19	41	19	56	20	13	20	35	21	04	19	36	19	55	20	32	20	34
19	20	12	20	24	20	37	20	51	21	08	21	33	20	16	20	37	21	11	21	15
20	20	56	21	05	21	15	21	25	21	39	21	56	20	53	21	18	21	46	21	54
21	21	39	21	45	21	51	21	58	22	06	22	17	21	29	21	56	22	18	22	29
22	22	20	22	23	22	25	22	28	22	32	22	37	22	02	22	33	22	50	23	05
23	23	02	23	01	23	00	22	59	22	57	22	56	22	36	23	10	23	21	23	40
24	23	44	23	40	23	35	23	30	23	24	23	15	23	10	23	48	23	53	**	**
25	**	**	**	**	**	**	**	**	23	52	23	36	23	46	**	**	**	**	0	15
26	0	28	0	20	0	12	0	03	**	**	**	**	**	**	0	27	0	26	0	53
27	1	15	1	04	0	53	0	39	0	23	0	01	0	25	1	11	1	03	1	34
28	2	06	1	52	1	37	1	21	1	00	0	31	1	09	1	57	1	45	2	19
29	3	01	2	45	2	28	2	08	1	44	1	10	1	59	2	49	2	33	3	10
30	4	00	3	42	3	24	3	03	2	36	1	59	2	54	3	47	3	28	4	06
31	5	01	4	44	4	25	4	04	3	38	3	00	3	56	4	48	4	29	5	08
Aug. 1	6	03	5	47	5	31	5	11	4	47	4	13	5	01	5	52	5	37	6	13
2	7	03	6	50	6	37	6	21	6	02	5	34	6	08	6	56	6	45	7	19
3	8	01	7	52	7	42	7	31	7	17	6	58	7	15	7	59	7	55	8	23
4	8	56	8	51	8	45	8	39	8	32	8	21	8	19	8	59	9	02	9	26
5	9	48	9	47	9	47	9	46	9	44	9	43	9	22	9	57	10	07	10	26
6	10	39	10	42	10	46	10	50	10	55	11	02	10	22	10	53	11	11	11	26
7	11	29	11	36	11	44	11	53	12	04	12	19	11	22	11	48	12	13	12	23
8	12	19	12	30	12	41	12	54	13	11	13	33	12	20	12	42	13	14	13	20
9	13	10	13	23	13	38	13	54	14	15	14	45	13	18	13	37	14	14	14	16
10	14	01	14	17	14	33	14	53	15	17	15	52	14	14	14	31	15	12	15	12
11	14	52	15	09	15	28	15	49	16	15	16	53	15	09	15	25	16	07	16	06
12	15	44	16	01	16	19	16	41	17	07	17	46	16	00	16	16	17	00	16	57
13	16	34	16	51	17	08	17	28	17	54	18	30	16	49	17	05	17	48	17	46
14	17	23	17	38	17	53	18	12	18	34	19	06	17	34	17	52	18	31	18	31
15	18	09	18	22	18	35	18	51	19	10	19	36	18	15	18	35	19	10	19	14
16	18	54	19	04	19	14	19	26	19	41	20	01	18	53	19	16	19	46	19	53

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2019

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

	FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date \ Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
July 1	16	47	17	03	17	20	17	40	18	05	18	40	17	01	17	18	17	59	17	59
2	17	46	18	03	18	22	18	43	19	10	19	48	18	02	18	18	19	02	19	00
3	18	47	19	04	19	23	19	44	20	10	20	47	19	03	19	20	20	02	20	01
4	19	48	20	04	20	20	20	39	21	03	21	35	20	01	20	18	20	58	20	59
5	20	47	21	00	21	14	21	29	21	48	22	15	20	53	21	14	21	49	21	53
6	21	44	21	53	22	03	22	14	22	28	22	46	21	42	22	06	22	34	22	42
7	22	37	22	42	22	48	22	55	23	03	23	13	22	26	22	54	23	16	23	28
8	23	28	23	29	23	31	23	32	23	34	23	37	23	07	23	40	23	54	**	**
9	**	**	**	**	**	**	**	**	**	**	24	00	23	48	**	**	**	**	0	10
10	0	17	0	15	0	12	0	09	0	05	**	**	**	**	0	23	0	31	0	52
11	1	06	1	00	0	53	0	45	0	36	0	23	0	27	1	08	1	08	1	34
12	1	56	1	46	1	35	1	23	1	09	0	49	1	08	1	52	1	47	2	16
13	2	46	2	33	2	19	2	03	1	44	1	17	1	51	2	38	2	27	3	01
14	3	37	3	22	3	06	2	47	2	24	1	51	2	37	3	27	3	12	3	48
15	4	29	4	12	3	55	3	34	3	08	2	31	3	26	4	17	3	59	4	36
16	5	21	5	04	4	46	4	24	3	57	3	19	4	16	5	08	4	49	5	28
17	6	12	5	56	5	38	5	17	4	51	4	14	5	09	6	00	5	42	6	19
18	7	02	6	46	6	30	6	11	5	48	5	14	6	01	6	51	6	36	7	12
19	7	49	7	36	7	22	7	06	6	46	6	17	6	53	7	41	7	30	8	03
20	8	34	8	24	8	12	8	00	7	44	7	22	7	45	8	29	8	23	8	53
21	9	17	9	10	9	02	8	53	8	42	8	26	8	35	9	17	9	16	9	43
22	9	59	9	55	9	50	9	45	9	39	9	30	9	25	10	03	10	08	10	30
23	10	40	10	39	10	39	10	38	10	36	10	35	10	14	10	48	11	00	11	19
24	11	22	11	25	11	27	11	31	11	35	11	40	11	04	11	35	11	52	12	07
25	12	05	12	11	12	17	12	25	12	34	12	47	11	55	12	22	12	46	12	57
26	12	50	13	00	13	10	13	21	13	36	13	55	12	48	13	12	13	42	13	49
27	13	39	13	51	14	05	14	20	14	39	15	06	13	44	14	05	14	40	14	43
28	14	32	14	47	15	03	15	21	15	45	16	17	14	43	15	01	15	41	15	41
29	15	28	15	45	16	03	16	24	16	50	17	27	15	44	16	00	16	43	16	41
30	16	29	16	46	17	04	17	26	17	52	18	30	16	45	17	01	17	45	17	43
31	17	30	17	47	18	04	18	24	18	50	19	25	17	45	18	02	18	43	18	43
Aug. 1	18	32	18	46	19	01	19	18	19	40	20	09	18	41	19	00	19	38	19	40
2	19	31	19	42	19	54	20	07	20	23	20	45	19	33	19	55	20	26	20	32
3	20	27	20	34	20	42	20	50	21	01	21	14	20	20	20	46	21	11	21	21
4	21	21	21	24	21	27	21	30	21	35	21	40	21	04	21	35	21	52	22	06
5	22	13	22	11	22	10	22	08	22	07	22	04	21	46	22	20	22	30	22	50
6	23	03	22	58	22	52	22	46	22	38	22	28	22	26	23	06	23	09	23	33
7	23	53	23	44	23	34	23	24	23	10	22	53	23	08	23	51	23	47	**	**
8	**	**	**	**	**	**	**	**	23	45	23	20	23	51	**	**	**	**	0	15
9	0	43	0	31	0	18	0	03	**	**	23	52	**	**	0	37	0	27	1	00
10	1	34	1	19	1	04	0	46	0	23	**	**	0	35	1	25	1	10	1	46
11	2	26	2	09	1	52	1	31	1	06	0	30	1	23	2	13	1	56	2	33
12	3	17	3	00	2	42	2	20	1	54	1	15	2	12	3	04	2	45	3	24
13	4	08	3	51	3	33	3	12	2	45	2	08	3	04	3	55	3	37	4	15
14	4	58	4	42	4	25	4	05	3	41	3	06	3	56	4	46	4	30	5	07
15	5	45	5	32	5	17	5	00	4	38	4	08	4	48	5	37	5	24	5	58
16	6	31	6	20	6	08	5	54	5	36	5	12	5	40	6	25	6	17	6	49

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2019
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

	FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date \ Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Aug. 16	18	54	19	04	19	14	19	26	19	41	20	01	18	53	19	16	19	46	19	53
17	19	37	19	43	19	51	19	59	20	09	20	22	19	29	19	55	20	19	20	29
18	20	18	20	22	20	26	20	30	20	35	20	42	20	03	20	32	20	51	21	05
19	20	59	21	00	21	00	21	00	21	00	21	01	20	36	21	09	21	22	21	40
20	21	41	21	38	21	34	21	31	21	26	21	20	21	10	21	47	21	53	22	14
21	22	24	22	17	22	10	22	02	21	53	21	40	21	45	22	25	22	25	22	51
22	23	09	22	59	22	48	22	37	22	22	22	02	22	21	23	05	23	00	23	30
23	23	56	23	44	23	30	23	15	22	56	22	29	23	02	23	49	23	39	**	**
24	**	**	**	**	**	**	23	58	23	35	23	03	23	48	**	**	**	**	0	11
25	0	48	0	33	0	16	**	**	**	**	23	45	**	**	0	37	0	22	0	58
26	1	43	1	26	1	08	0	48	0	22	**	**	0	39	1	31	1	13	1	51
27	2	42	2	25	2	06	1	45	1	18	0	39	1	37	2	29	2	10	2	48
28	3	43	3	26	3	08	2	48	2	22	1	46	2	39	3	31	3	13	3	51
29	4	44	4	29	4	14	3	56	3	34	3	03	3	45	4	34	4	21	4	56
30	5	43	5	32	5	20	5	07	4	50	4	26	4	52	5	39	5	31	6	02
31	6	41	6	34	6	26	6	17	6	07	5	52	5	59	6	41	6	40	7	07
Sept. 1	7	36	7	33	7	30	7	27	7	22	7	17	7	04	7	42	7	49	8	10
2	8	29	8	30	8	32	8	34	8	37	8	40	8	08	8	40	8	55	9	12
3	9	21	9	27	9	33	9	40	9	49	10	01	9	10	9	38	10	01	10	12
4	10	13	10	22	10	32	10	44	10	59	11	19	10	11	10	34	11	04	11	11
5	11	04	11	17	11	31	11	47	12	06	12	34	11	11	11	31	12	06	12	09
6	11	57	12	12	12	28	12	47	13	11	13	44	12	08	12	26	13	06	13	07
7	12	49	13	06	13	24	13	44	14	11	14	48	13	05	13	21	14	03	14	02
8	13	40	13	58	14	16	14	38	15	05	15	44	13	58	14	13	14	57	14	54
9	14	31	14	48	15	06	15	27	15	53	16	30	14	47	15	03	15	46	15	44
10	15	20	15	36	15	52	16	11	16	35	17	08	15	33	15	50	16	30	16	30
11	16	07	16	21	16	35	16	51	17	12	17	40	16	15	16	34	17	11	17	13
12	16	52	17	03	17	14	17	27	17	44	18	06	16	54	17	16	17	47	17	53
13	17	35	17	43	17	51	18	01	18	12	18	28	17	30	17	55	18	21	18	30
14	18	17	18	22	18	27	18	32	18	39	18	48	18	04	18	33	18	53	19	06
15	18	59	19	00	19	01	19	03	19	04	19	07	18	37	19	10	19	24	19	41
16	19	40	19	38	19	35	19	33	19	30	19	25	19	11	19	47	19	55	20	15
17	20	22	20	17	20	11	20	04	19	56	19	45	19	45	20	24	20	26	20	51
18	21	06	20	57	20	48	20	37	20	24	20	06	20	21	21	04	21	00	21	29
19	21	52	21	40	21	27	21	13	20	55	20	31	21	00	21	46	21	37	22	09
20	22	41	22	27	22	11	21	53	21	31	21	01	21	43	22	32	22	18	22	53
21	23	34	23	17	23	00	22	39	22	14	21	39	22	30	23	22	23	04	23	42
22	**	**	**	**	23	53	23	32	23	05	22	26	23	24	**	**	23	57	**	**
23	0	29	0	12	**	**	**	**	**	**	23	26	**	**	0	16	**	**	0	35
24	1	27	1	10	0	52	0	30	0	04	**	**	0	22	1	14	0	56	1	34
25	2	26	2	11	1	54	1	35	1	10	0	36	1	25	2	15	2	00	2	36
26	3	25	3	12	2	58	2	43	2	23	1	55	2	30	3	18	3	07	3	41
27	4	23	4	13	4	03	3	52	3	38	3	18	3	36	4	20	4	16	4	45
28	5	18	5	13	5	08	5	02	4	54	4	44	4	42	5	21	5	25	5	49
29	6	13	6	12	6	11	6	11	6	10	6	09	5	47	6	21	6	32	6	52
30	7	06	7	10	7	14	7	19	7	25	7	33	6	50	7	21	7	40	7	54
Oct. 1	8	00	8	08	8	16	8	26	8	38	8	55	7	54	8	19	8	46	8	55

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2019

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Aug.	16	6	31	6	20	6	08	5	54	5	36	5	12	5	40	6	25	6	17	6	49
	17	7	15	7	06	6	57	6	47	6	34	6	17	6	30	7	13	7	10	7	38
	18	7	57	7	52	7	46	7	40	7	32	7	21	7	20	7	59	8	02	8	26
	19	8	38	8	36	8	34	8	32	8	29	8	25	8	09	8	45	8	54	9	14
	20	9	19	9	21	9	23	9	24	9	27	9	30	8	59	9	31	9	46	10	02
	21	10	01	10	06	10	12	10	18	10	25	10	35	9	49	10	17	10	38	10	51
	22	10	45	10	53	11	02	11	12	11	25	11	42	10	40	11	05	11	33	11	41
	23	11	31	11	42	11	55	12	09	12	26	12	50	11	34	11	56	12	28	12	33
	24	12	21	12	35	12	50	13	07	13	29	13	59	12	29	12	48	13	27	13	28
	25	13	14	13	30	13	48	14	07	14	33	15	08	13	28	13	45	14	26	14	25
	26	14	11	14	28	14	47	15	08	15	35	16	13	14	27	14	43	15	27	15	25
	27	15	11	15	28	15	46	16	07	16	34	17	11	15	27	15	43	16	26	16	24
	28	16	12	16	27	16	44	17	03	17	26	17	59	16	24	16	42	17	22	17	23
	29	17	12	17	25	17	38	17	54	18	13	18	39	17	18	17	39	18	14	18	17
	30	18	11	18	20	18	29	18	40	18	54	19	12	18	08	18	32	19	01	19	09
	31	19	07	19	12	19	17	19	23	19	30	19	39	18	54	19	23	19	44	19	57
Sept.	1	20	01	20	02	20	02	20	03	20	04	20	05	19	39	20	11	20	24	20	42
	2	20	54	20	50	20	46	20	42	20	36	20	29	20	21	20	58	21	04	21	27
	3	21	46	21	38	21	30	21	21	21	09	20	54	21	03	21	45	21	44	22	10
	4	22	37	22	26	22	14	22	01	21	44	21	21	21	47	22	32	22	24	22	55
	5	23	29	23	15	23	00	22	43	22	22	21	52	22	32	23	21	23	08	23	42
	6	**	**	**	**	23	48	23	28	23	04	22	29	23	20	**	**	23	53	**	**
	7	0	22	0	05	**	**	**	**	23	50	23	12	**	**	0	10	**	**	0	30
	8	1	14	0	56	0	38	0	17	**	**	**	**	0	09	1	01	0	42	1	20
	9	2	05	1	48	1	29	1	08	0	41	0	02	1	00	1	52	1	33	2	11
	10	2	55	2	39	2	21	2	01	1	35	0	59	1	52	2	43	2	25	3	03
	11	3	43	3	28	3	13	2	55	2	32	2	00	2	44	3	33	3	19	3	54
	12	4	29	4	17	4	04	3	49	3	30	3	04	3	36	4	22	4	12	4	45
	13	5	13	5	04	4	54	4	42	4	28	4	08	4	26	5	10	5	06	5	35
	14	5	56	5	49	5	43	5	35	5	26	5	13	5	17	5	57	5	58	6	23
	15	6	37	6	34	6	31	6	28	6	23	6	17	6	06	6	43	6	50	7	11
	16	7	19	7	19	7	20	7	20	7	21	7	22	6	55	7	29	7	42	7	59
	17	8	00	8	04	8	08	8	13	8	19	8	27	7	45	8	15	8	34	8	48
	18	8	43	8	50	8	58	9	07	9	18	9	33	8	36	9	02	9	28	9	37
	19	9	28	9	38	9	50	10	02	10	19	10	41	9	29	9	51	10	22	10	28
	20	10	15	10	29	10	43	11	00	11	20	11	49	10	22	10	42	11	19	11	22
	21	11	06	11	22	11	39	11	58	12	22	12	57	11	19	11	36	12	17	12	16
	22	12	00	12	17	12	36	12	57	13	24	14	01	12	16	12	32	13	16	13	14
	23	12	57	13	14	13	33	13	55	14	22	15	00	13	14	13	30	14	13	14	11
	24	13	56	14	12	14	30	14	50	15	15	15	51	14	10	14	27	15	09	15	08
	25	14	54	15	09	15	24	15	42	16	03	16	33	15	04	15	23	16	01	16	03
	26	15	53	16	04	16	15	16	29	16	45	17	08	15	55	16	17	16	49	16	54
	27	16	49	16	56	17	04	17	13	17	23	17	37	16	42	17	09	17	34	17	44
	28	17	44	17	47	17	50	17	54	17	58	18	03	17	27	17	58	18	15	18	30
	29	18	38	18	37	18	35	18	33	18	31	18	28	18	10	18	46	18	55	19	15
	30	19	32	19	26	19	20	19	13	19	04	18	52	18	54	19	34	19	36	20	00
Oct.	1	20	25	20	15	20	05	19	53	19	39	19	19	19	38	20	22	20	16	20	46

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2019

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Oct.	1	8	00	8	08	8	16	8	26	8	38	8	55	7	54	8	19	8	46	8	55
	2	8	53	9	05	9	17	9	32	9	50	10	15	8	56	9	18	9	52	9	56
	3	9	47	10	02	10	17	10	35	10	58	11	30	9	57	10	16	10	55	10	56
	4	10	41	10	58	11	15	11	36	12	02	12	39	10	56	11	13	11	55	11	54
	5	11	34	11	52	12	11	12	32	13	00	13	39	11	52	12	07	12	51	12	49
	6	12	26	12	44	13	02	13	24	13	51	14	29	12	43	12	59	13	43	13	41
	7	13	17	13	33	13	50	14	10	14	35	15	10	13	31	13	48	14	29	14	28
	8	14	04	14	19	14	34	14	52	15	13	15	44	14	14	14	33	15	11	15	12
	9	14	50	15	02	15	14	15	29	15	47	16	11	14	54	15	15	15	49	15	53
	10	15	34	15	43	15	52	16	03	16	16	16	34	15	31	15	55	16	23	16	30
	11	16	16	16	22	16	28	16	35	16	43	16	54	16	05	16	33	16	55	17	07
	12	16	57	17	00	17	02	17	05	17	08	17	13	16	39	17	10	17	27	17	42
	13	17	39	17	38	17	37	17	35	17	34	17	31	17	13	17	47	17	57	18	16
	14	18	21	18	16	18	11	18	06	17	59	17	50	17	47	18	24	18	28	18	52
	15	19	04	18	56	18	48	18	38	18	27	18	11	18	22	19	04	19	02	19	29
	16	19	50	19	39	19	27	19	13	18	57	18	34	19	00	19	45	19	38	20	08
	17	20	38	20	24	20	09	19	52	19	31	19	02	19	42	20	29	20	17	20	51
	18	21	30	21	13	20	56	20	36	20	12	19	37	20	27	21	18	21	01	21	38
	19	22	24	22	06	21	47	21	26	20	59	20	21	21	18	22	10	21	51	22	29
	20	23	20	23	02	22	43	22	21	21	54	21	15	22	13	23	06	22	46	23	26
	21	**	**	**	**	23	42	23	22	22	56	22	20	23	13	**	**	23	47	**	**
	22	0	17	0	00	**	**	**	**	**	**	23	33	**	**	0	04	**	**	0	24
	23	1	14	0	59	0	44	0	26	0	04	**	**	0	15	1	04	0	51	1	26
	24	2	09	1	58	1	46	1	33	1	16	0	52	1	19	2	04	1	57	2	28
	25	3	04	2	57	2	49	2	40	2	29	2	14	2	22	3	04	3	04	3	30
	26	3	57	3	54	3	51	3	48	3	43	3	37	3	26	4	03	4	10	4	32
	27	4	50	4	52	4	53	4	55	4	58	5	01	4	29	5	02	5	17	5	34
	28	5	43	5	49	5	56	6	03	6	12	6	24	5	33	6	00	6	23	6	35
	29	6	37	6	47	6	58	7	10	7	25	7	46	6	36	7	00	7	30	7	37
	30	7	32	7	45	8	00	8	16	8	37	9	06	7	39	7	59	8	35	8	38
	31	8	27	8	43	9	01	9	20	9	45	10	21	8	41	8	58	9	40	9	39
Nov.	1	9	23	9	40	9	59	10	21	10	48	11	27	9	40	9	56	10	39	10	37
	2	10	17	10	35	10	54	11	16	11	44	12	24	10	35	10	50	11	35	11	32
	3	11	09	11	27	11	45	12	06	12	32	13	09	11	26	11	42	12	24	12	22
	4	11	59	12	15	12	31	12	50	13	13	13	46	12	11	12	29	13	09	13	09
	5	12	46	12	59	13	13	13	29	13	48	14	15	12	53	13	13	13	48	13	51
	6	13	31	13	41	13	52	14	04	14	19	14	40	13	31	13	54	14	23	14	30
	7	14	13	14	20	14	28	14	36	14	47	15	01	14	06	14	32	14	57	15	07
	8	14	55	14	59	15	02	15	07	15	12	15	20	14	39	15	09	15	28	15	42
	9	15	36	15	36	15	37	15	37	15	37	15	38	15	13	15	46	15	59	16	16
	10	16	18	16	15	16	11	16	07	16	02	15	56	15	47	16	23	16	29	16	51
	11	17	01	16	54	16	47	16	39	16	29	16	16	16	21	17	02	17	02	17	28
	12	17	46	17	36	17	25	17	13	16	58	16	38	16	59	17	43	17	37	18	06
	13	18	34	18	21	18	07	17	51	17	31	17	04	17	40	18	27	18	15	18	49
	14	19	26	19	10	18	53	18	34	18	10	17	37	18	24	19	15	18	59	19	35
	15	20	20	20	02	19	44	19	22	18	55	18	18	19	15	20	06	19	48	20	26
	16	21	16	20	58	20	38	20	16	19	48	19	09	20	09	21	02	20	42	21	21

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2019

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

Date \ Lat.	FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T. 0º		10º		20º		30º		40º		50º		FOR CERTAIN STATIONS IN INDIA IN I.S.T. Kolkata		Chennai		Delhi		Mumbai	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Oct. 1	20	25	20	15	20	05	19	53	19	39	19	19	19	38	20	22	20	16	20	46
2	21	19	21	06	20	52	20	36	20	16	19	49	20	24	21	11	21	00	21	34
3	22	13	21	57	21	41	21	21	20	58	20	24	21	12	22	02	21	46	22	22
4	23	07	22	50	22	31	22	10	21	43	21	06	22	02	22	54	22	35	23	14
5	24	00	23	42	23	23	23	01	22	34	21	55	22	54	23	46	23	27	**	**
6	**	**	**	**	**	**	23	55	23	28	22	50	23	46	**	**	**	**	0	05
7	0	51	0	34	0	16	**	**	**	**	23	51	**	**	0	38	0	19	0	58
8	1	40	1	24	1	08	0	49	0	25	**	**	0	39	1	29	1	13	1	50
9	2	27	2	13	1	59	1	43	1	23	0	54	1	31	2	18	2	07	2	40
10	3	11	3	01	2	50	2	37	2	21	1	59	2	22	3	07	3	00	3	31
11	3	54	3	47	3	39	3	30	3	19	3	03	3	12	3	54	3	53	4	19
12	4	36	4	32	4	28	4	23	4	16	4	08	4	02	4	40	4	45	5	08
13	5	17	5	17	5	16	5	15	5	14	5	13	4	51	5	26	5	37	5	56
14	5	59	6	02	6	05	6	08	6	13	6	19	5	42	6	12	6	29	6	44
15	6	42	6	48	6	55	7	03	7	12	7	25	6	32	6	59	7	23	7	34
16	7	26	7	36	7	46	7	58	8	13	8	33	7	25	7	48	8	18	8	25
17	8	13	8	26	8	39	8	55	9	14	9	42	8	18	8	39	9	15	9	18
18	9	03	9	18	9	34	9	53	10	17	10	50	9	15	9	32	10	12	10	12
19	9	55	10	12	10	31	10	52	11	18	11	56	10	11	10	27	11	10	11	09
20	10	50	11	08	11	27	11	49	12	17	12	56	11	08	11	23	12	07	12	05
21	11	47	12	04	12	23	12	44	13	10	13	48	12	03	12	19	13	03	13	01
22	12	44	13	00	13	16	13	35	13	59	14	31	12	56	13	14	13	54	13	54
23	13	40	13	53	14	07	14	22	14	41	15	07	13	47	14	07	14	42	14	45
24	14	35	14	45	14	54	15	05	15	19	15	37	14	33	14	57	15	26	15	34
25	15	29	15	34	15	40	15	46	15	53	16	03	15	18	15	46	16	07	16	19
26	16	23	16	23	16	24	16	25	16	26	16	27	16	00	16	33	16	46	17	04
27	17	15	17	12	17	08	17	04	16	58	16	51	16	43	17	20	17	26	17	48
28	18	09	18	01	17	53	17	43	17	32	17	16	17	27	18	08	18	06	18	33
29	19	03	18	52	18	39	18	25	18	08	17	44	18	12	18	58	18	49	19	21
30	19	59	19	44	19	28	19	10	18	48	18	17	19	00	19	49	19	35	20	10
31	20	54	20	37	20	19	19	59	19	33	18	56	19	50	20	41	20	23	21	01
Nov. 1	21	49	21	31	21	12	20	50	20	23	19	43	20	43	21	36	21	16	21	55
2	22	43	22	25	22	06	21	44	21	17	20	37	21	37	22	29	22	09	22	48
3	23	34	23	17	23	00	22	40	22	14	21	38	22	30	23	22	23	04	23	42
4	**	**	**	**	23	52	23	35	23	12	22	41	23	24	**	**	23	59	**	**
5	0	22	0	08	**	**	**	**	**	**	23	46	**	**	0	12	**	**	0	34
6	1	08	0	56	0	44	0	29	0	11	**	**	0	15	1	02	0	53	1	25
7	1	51	1	43	1	33	1	23	1	09	0	51	1	06	1	49	1	46	2	14
8	2	33	2	28	2	22	2	16	2	07	1	56	1	56	2	35	2	38	3	03
9	3	15	3	13	3	11	3	08	3	05	3	01	2	45	3	22	3	30	3	51
10	3	56	3	58	3	59	4	01	4	03	4	07	3	36	4	07	4	22	4	39
11	4	38	4	44	4	49	4	55	5	03	5	13	4	26	4	54	5	16	5	28
12	5	23	5	31	5	40	5	51	6	04	6	21	5	19	5	43	6	11	6	19
13	6	09	6	21	6	34	6	48	7	06	7	31	6	12	6	34	7	08	7	12
14	6	59	7	13	7	29	7	47	8	09	8	41	7	09	7	28	8	06	8	07
15	7	51	8	08	8	26	8	46	9	12	9	49	8	06	8	22	9	05	9	04
16	8	46	9	04	9	23	9	45	10	13	10	53	9	04	9	19	10	04	10	01

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE, 2019
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

	FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Lat. / Date	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Nov. 16	21	16	20	58	20	38	20	16	19	48	19	09	20	09	21	02	20	42	21	21
17	22	12	21	55	21	37	21	15	20	49	20	10	21	08	22	00	21	41	22	19
18	23	09	22	53	22	37	22	18	21	54	21	21	22	08	22	58	22	43	23	19
19	**	**	23	51	23	38	23	23	23	04	22	37	23	10	23	57	23	47	**	**
20	0	04	**	**	**	**	**	**	**	**	23	56	**	**	**	**	**	**	0	20
21	0	57	0	48	0	39	0	28	0	15	**	**	0	12	0	55	0	52	1	20
22	1	49	1	44	1	39	1	33	1	26	1	16	1	13	1	52	1	56	2	19
23	2	40	2	39	2	39	2	38	2	37	2	37	2	14	2	48	3	00	3	19
24	3	31	3	35	3	39	3	43	3	49	3	57	3	15	3	45	4	04	4	18
25	4	23	4	31	4	39	4	49	5	01	5	18	4	17	4	43	5	10	5	19
26	5	16	5	28	5	41	5	55	6	13	6	39	5	20	5	41	6	15	6	19
27	6	11	6	26	6	42	7	01	7	24	7	56	6	22	6	40	7	20	7	21
28	7	07	7	25	7	43	8	04	8	30	9	08	7	24	7	40	8	22	8	21
29	8	03	8	21	8	41	9	03	9	31	10	11	8	21	8	36	9	22	9	19
30	8	58	9	16	9	35	9	56	10	24	11	03	9	16	9	31	10	15	10	12
Dec. 1	9	50	10	06	10	24	10	44	11	09	11	45	10	04	10	21	11	03	11	02
2	10	39	10	53	11	08	11	26	11	47	12	17	10	48	11	07	11	45	11	47
3	11	25	11	37	11	49	12	03	12	20	12	44	11	29	11	50	12	22	12	27
4	12	09	12	17	12	26	12	36	12	49	13	06	12	05	12	29	12	57	13	05
5	12	51	12	56	13	01	13	08	13	15	13	25	12	39	13	07	13	29	13	41
6	13	32	13	34	13	35	13	37	13	40	13	43	13	12	13	44	13	59	14	15
7	14	13	14	11	14	09	14	07	14	05	14	01	13	45	14	20	14	29	14	49
8	14	55	14	50	14	44	14	38	14	30	14	20	14	19	14	58	15	01	15	25
9	15	39	15	31	15	22	15	11	14	58	14	41	14	55	15	38	15	35	16	02
10	16	27	16	15	16	02	15	47	15	30	15	05	15	35	16	20	16	11	16	43
11	17	17	17	02	16	47	16	28	16	06	15	35	16	18	17	07	16	53	17	28
12	18	11	17	54	17	36	17	15	16	49	16	13	17	07	17	58	17	41	18	18
13	19	08	18	50	18	31	18	08	17	41	17	01	18	01	18	54	18	34	19	13
14	20	06	19	48	19	29	19	07	18	40	18	00	19	00	19	53	19	33	20	12
15	21	04	20	48	20	30	20	10	19	45	19	10	20	01	20	52	20	36	21	13
16	22	00	21	47	21	32	21	16	20	55	20	26	21	04	21	52	21	41	22	14
17	22	54	22	44	22	33	22	21	22	06	21	45	22	06	22	51	22	45	23	15
18	23	46	23	40	23	33	23	26	23	17	23	04	23	07	23	48	23	49	**	**
19	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	14
20	0	36	0	34	0	32	0	30	0	27	0	23	0	07	0	43	0	52	1	13
21	1	26	1	28	1	30	1	33	1	37	1	41	1	07	1	38	1	55	2	10
22	2	16	2	22	2	29	2	37	2	46	3	00	2	06	2	33	2	57	3	08
23	3	07	3	17	3	28	3	41	3	56	4	18	3	06	3	30	4	00	4	07
24	4	00	4	13	4	28	4	45	5	06	5	35	4	07	4	27	5	04	5	06
25	4	54	5	11	5	28	5	48	6	13	6	49	5	08	5	25	6	07	6	06
26	5	50	6	08	6	26	6	48	7	16	7	56	6	07	6	22	7	07	7	05
27	6	45	7	03	7	22	7	45	8	13	8	53	7	04	7	18	8	03	8	00
28	7	39	7	56	8	14	8	35	9	02	9	39	7	55	8	11	8	54	8	52
29	8	30	8	45	9	01	9	20	9	44	10	16	8	42	8	59	9	39	9	40
30	9	18	9	30	9	44	10	00	10	19	10	45	9	24	9	44	10	19	10	22
31	10	03	10	13	10	23	10	35	10	50	11	09	10	02	10	25	10	55	11	02
32	10	46	10	52	10	59	11	07	11	17	11	30	10	37	11	04	11	28	11	38

The symbol (**) indicates that the phenomenon will occur on the next day

MOONSET, 2019
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

Date		FOR THE CENTRAL MERIDIAN OF INDIA (82º.5 E) IN L. M. T.												FOR CERTAIN STATIONS IN INDIA IN I.S.T.							
Date	Lat.	0º		10º		20º		30º		40º		50º		Kolkata		Chennai		Delhi		Mumbai	
		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Nov.	16	8	46	9	04	9	23	9	45	10	13	10	53	9	04	9	19	10	04	10	01
	17	9	43	10	01	10	19	10	41	11	09	11	48	10	01	10	16	11	00	10	58
	18	10	40	10	56	11	13	11	33	11	58	12	33	10	54	11	11	11	52	11	52
	19	11	35	11	49	12	04	12	21	12	42	13	10	11	44	12	03	12	40	12	42
	20	12	29	12	40	12	51	13	04	13	20	13	41	12	30	12	53	13	24	13	30
	21	13	22	13	29	13	36	13	44	13	54	14	07	13	14	13	40	14	04	14	15
	22	14	13	14	16	14	19	14	22	14	25	14	30	13	55	14	26	14	43	14	58
	23	15	04	15	02	15	01	14	59	14	56	14	53	14	36	15	12	15	21	15	41
	24	15	56	15	50	15	43	15	36	15	28	15	16	15	18	15	57	15	59	16	24
	25	16	48	16	38	16	28	16	16	16	01	15	42	16	01	16	45	16	39	17	09
	26	17	43	17	29	17	15	16	59	16	39	16	11	16	47	17	35	17	23	17	57
	27	18	38	18	22	18	05	17	46	17	21	16	47	17	37	18	27	18	10	18	47
	28	19	34	19	17	18	58	18	36	18	09	17	30	18	28	19	21	19	02	19	40
	29	20	30	20	12	19	53	19	30	19	02	18	22	19	23	20	16	19	56	20	35
	30	21	23	21	06	20	48	20	26	19	59	19	21	20	18	21	10	20	51	21	30
Dec.	1	22	14	21	59	21	42	21	23	20	59	20	25	21	13	22	03	21	48	22	23
	2	23	02	22	49	22	35	22	19	21	59	21	30	22	06	22	54	22	42	23	16
	3	23	46	23	36	23	26	23	13	22	58	22	36	22	58	23	43	23	37	**	**
	4	**	**	**	**	**	**	**	**	23	56	23	42	23	49	**	**	**	**	0	06
	5	0	29	0	22	0	15	0	06	**	**	**	**	**	**	0	29	0	29	0	55
	6	1	11	1	07	1	03	0	59	0	54	0	47	0	38	1	15	1	21	1	44
	7	1	52	1	52	1	52	1	52	1	52	1	51	1	27	2	01	2	13	2	31
	8	2	33	2	37	2	40	2	45	2	50	2	57	2	17	2	47	3	06	3	20
	9	3	16	3	23	3	31	3	39	3	50	4	05	3	09	3	35	4	00	4	10
	10	4	02	4	12	4	23	4	36	4	52	5	14	4	02	4	25	4	56	5	02
	11	4	50	5	04	5	18	5	35	5	56	6	25	4	58	5	18	5	54	5	57
	12	5	43	5	59	6	16	6	36	7	00	7	36	5	56	6	13	6	54	6	54
	13	6	38	6	56	7	14	7	36	8	04	8	43	6	55	7	11	7	55	7	53
	14	7	36	7	54	8	13	8	35	9	03	9	43	7	54	8	09	8	54	8	51
	15	8	34	8	51	9	09	9	30	9	56	10	33	8	50	9	06	9	49	9	47
	16	9	31	9	46	10	02	10	20	10	42	11	13	9	42	10	00	10	39	10	40
	17	10	26	10	38	10	50	11	05	11	22	11	46	10	30	10	51	11	25	11	30
	18	11	19	11	27	11	36	11	45	11	57	12	13	11	14	11	40	12	06	12	15
	19	12	10	12	14	12	18	12	23	12	29	12	37	11	56	12	25	12	44	12	58
	20	13	00	13	00	13	00	12	59	12	59	12	59	12	35	13	09	13	21	13	40
	21	13	49	13	45	13	41	13	35	13	29	13	21	13	15	13	53	13	58	14	21
	22	14	40	14	32	14	23	14	13	14	01	13	44	13	56	14	38	14	36	15	04
	23	15	32	15	20	15	07	14	53	14	35	14	11	14	40	15	26	15	17	15	49
	24	16	26	16	11	15	55	15	37	15	14	14	43	15	27	16	15	16	01	16	36
	25	17	21	17	04	16	46	16	25	15	59	15	22	16	16	17	08	16	50	17	28
	26	18	17	17	59	17	39	17	17	16	49	16	09	17	10	18	02	17	43	18	21
	27	19	11	18	53	18	34	18	12	17	45	17	05	18	05	18	57	18	37	19	17
	28	20	04	19	47	19	30	19	09	18	44	18	07	19	00	19	52	19	34	20	11
	29	20	53	20	39	20	24	20	06	19	44	19	13	19	55	20	44	20	30	21	05
	30	21	40	21	28	21	16	21	02	20	44	20	20	20	48	21	34	21	26	21	57
	31	22	24	22	15	22	06	21	56	21	44	21	26	21	40	22	22	22	19	22	47
	32	23	06	23	01	22	55	22	49	22	42	22	31	22	29	23	08	23	12	23	36

The symbol (**) indicates that the phenomenon will occur on the next day

MOONRISE AND MOONSET
REDUCTION OF THE L.M.T. OF RISING OR SETTING FOR THE MERIDIAN OF 82°.5 E. LONGITUDE TO THE L.M.T. OF OTHER MERIDIANS

LONGITUDE EAST OF GREENWICH

Daily Variation in Rising or Setting	0°	30°	60°	68°	72°	76°	80°	84°	88°	92°	96°	120°	150°
m	m	m	m	m	m	m	m	m	m	m	m	m	m
28	+ 6.4	+ 4.1	+ 1.8	+ 1.1	+ 0.8	+ 0.5	+ 0.2	- 0.1	- 0.4	- 0.7	- 1.1	- 2.9	- 5.3
29	6.6	4.2	1.8	1.2	0.8	0.5	0.2	0.1	0.4	0.8	1.1	3.0	5.4
30	6.9	4.4	1.9	1.2	0.9	0.5	0.2	0.1	0.5	0.8	1.1	3.1	5.6
31	7.1	4.5	1.9	1.2	0.9	0.6	0.2	0.1	0.5	0.8	1.2	3.2	5.8
32	7.3	4.7	2.0	1.3	0.9	0.6	0.2	0.1	0.5	0.8	1.2	3.3	6.0
33	7.6	4.8	2.1	1.3	1.0	0.6	0.2	0.1	0.5	0.9	1.2	3.4	6.2
34	7.8	5.0	2.1	1.4	1.0	0.6	0.2	0.1	0.5	0.9	1.3	3.5	6.4
35	8.0	5.1	2.2	1.4	1.0	0.6	0.2	0.1	0.5	0.9	1.3	3.6	6.6
36	8.2	5.2	2.3	1.4	1.0	0.6	0.2	0.1	0.5	0.9	1.4	3.7	6.8
37	8.5	5.4	2.3	1.5	1.1	0.7	0.3	0.2	0.6	1.0	1.4	3.9	6.9
38	8.7	5.5	2.4	1.5	1.1	0.7	0.3	0.2	0.6	1.0	1.4	4.0	7.1
39	8.9	5.7	2.4	1.6	1.1	0.7	0.3	0.2	0.6	1.0	1.5	4.1	7.3
40	+ 9.2	+ 5.8	+ 2.5	+ 1.6	+ 1.2	+ 0.7	+ 0.3	- 0.2	- 0.6	- 1.1	- 1.5	- 4.2	- 7.5
41	9.4	6.0	2.6	1.7	1.2	0.7	0.3	0.2	0.6	1.1	1.5	4.3	7.7
42	9.6	6.1	2.6	1.7	1.2	0.8	0.3	0.2	0.6	1.1	1.6	4.4	7.9
43	9.9	6.3	2.7	1.7	1.3	0.8	0.3	0.2	0.7	1.1	1.6	4.5	8.1
44	10.1	6.4	2.8	1.8	1.3	0.8	0.3	0.2	0.7	1.2	1.7	4.6	8.3
45	10.3	6.6	2.8	1.8	1.3	0.8	0.3	0.2	0.7	1.2	1.7	4.7	8.4
46	10.5	6.7	2.9	1.9	1.3	0.8	0.3	0.2	0.7	1.2	1.7	4.8	8.6
47	10.8	6.9	2.9	1.9	1.4	0.8	0.3	0.2	0.7	1.2	1.8	4.9	8.8
48	11.0	7.0	3.0	1.9	1.4	0.9	0.3	0.2	0.7	1.3	1.8	5.0	9.0
49	11.2	7.1	3.1	2.0	1.4	0.9	0.3	0.2	0.7	1.3	1.8	5.1	9.2
50	+ 11.5	+ 7.3	+ 3.1	+ 2.0	+ 1.5	+ 0.9	+ 0.3	- 0.2	- 0.8	- 1.3	- 1.9	- 5.2	- 9.4
51	11.7	7.4	3.2	2.1	1.5	0.9	0.4	0.2	0.8	1.3	1.9	5.3	9.6
52	11.9	7.6	3.3	2.1	1.5	0.9	0.4	0.2	0.8	1.4	2.0	5.4	9.8
53	12.1	7.7	3.3	2.1	1.5	1.0	0.4	0.2	0.8	1.4	2.0	5.5	9.9
54	12.4	7.9	3.4	2.2	1.6	1.0	0.4	0.2	0.8	1.4	2.0	5.6	10.1
55	12.6	8.0	3.4	2.2	1.6	1.0	0.4	0.2	0.8	1.5	2.1	5.7	10.3
56	12.8	8.2	3.5	2.3	1.6	1.0	0.4	0.2	0.9	1.5	2.1	5.8	10.5
57	13.1	8.3	3.6	2.3	1.7	1.0	0.4	0.2	0.9	1.5	2.1	5.9	10.7
58	13.3	8.5	3.6	2.3	1.7	1.0	0.4	0.2	0.9	1.5	2.2	6.0	10.9
59	13.5	8.6	3.7	2.4	1.7	1.1	0.4	0.2	0.9	1.6	2.2	6.1	11.1
60	+ 13.7	+ 8.7	+ 3.8	+ 2.4	+ 1.7	+ 1.1	+ 0.4	- 0.2	- 0.9	- 1.6	- 2.3	- 6.2	- 11.3
61	14.0	8.9	3.8	2.5	1.8	1.1	0.4	0.3	0.9	1.6	2.3	6.4	11.4
62	14.2	9.0	3.9	2.5	1.8	1.1	0.4	0.3	0.9	1.6	2.3	6.5	11.6
63	14.4	9.2	3.9	2.5	1.8	1.1	0.4	0.3	1.0	1.7	2.4	6.6	11.8
64	14.7	9.3	4.0	2.6	1.9	1.2	0.4	0.3	1.0	1.7	2.4	6.7	12.0
65	14.9	9.5	4.1	2.6	1.9	1.2	0.5	0.3	1.0	1.7	2.4	6.8	12.2
66	15.1	9.6	4.1	2.7	1.9	1.2	0.5	0.3	1.0	1.7	2.5	6.9	12.4
67	15.4	9.8	4.2	2.7	2.0	1.2	0.5	0.3	1.0	1.8	2.5	7.0	12.6
68	15.6	9.9	4.3	2.7	2.0	1.2	0.5	0.3	1.0	1.8	2.6	7.1	12.8
69	15.8	10.1	4.3	2.8	2.0	1.2	0.5	0.3	1.1	1.8	2.6	7.2	12.9
70	+ 16.0	+ 10.2	+ 4.4	+ 2.8	+ 2.0	+ 1.3	+ 0.5	- 0.3	- 1.1	- 1.8	- 2.6	- 7.3	- 13.1
71	16.3	10.4	4.4	2.9	2.1	1.3	0.5	0.3	1.1	1.9	2.7	7.4	13.3
72	16.5	10.5	4.5	2.9	2.1	1.3	0.5	0.3	1.1	1.9	2.7	7.5	13.5
73	16.7	10.6	4.6	2.9	2.1	1.3	0.5	0.3	1.1	1.9	2.7	7.6	13.7
74	+ 17.0	+ 10.8	+ 4.6	+ 3.0	+ 2.2	+ 1.3	+ 0.5	- 0.3	- 1.1	- 2.0	- 2.8	- 7.7	- 13.9

SUNRISE, SUNSET AND MOONRISE, MOONSET
CORRECTION FOR LATITUDE

VARIATION PER 10° OF LATITUDE OF THE TIMES OF SUNRISE, SUNSET AND MOONRISE, MOONSET DISTRIBUTED OVER EACH DEGREE OF LATITUDE

Var. per 10° of Lat.	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	15'	30'	45'
m	m	m	m	m	m	m	m	m	m	m	m	m	m
5	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	0.1	0.3	0.4
6	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	0.2	0.3	0.5
7	0.7	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.0	0.2	0.4	0.5
8	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	0.2	0.4	0.6
9	0.9	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1	9.0	0.2	0.5	0.7
10	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	0.3	0.5	0.8
11	1.1	2.2	3.3	4.4	5.5	6.6	7.7	8.8	9.9	11.0	0.3	0.6	0.8
12	1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6	10.8	12.0	0.3	0.6	0.9
13	1.3	2.6	3.9	5.2	6.5	7.8	9.1	10.4	11.7	13.0	0.3	0.7	1.0
14	1.4	2.8	4.2	5.6	7.0	8.4	9.8	11.2	12.6	14.0	0.4	0.7	1.1
15	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0	0.4	0.8	1.1
16	1.6	3.2	4.8	6.4	8.0	9.6	11.2	12.8	14.4	16.0	0.4	0.8	1.2
17	1.7	3.4	5.1	6.8	8.5	10.2	11.9	13.6	15.3	17.0	0.4	0.9	1.3
18	1.8	3.6	5.4	7.2	9.0	10.8	12.6	14.4	16.2	18.0	0.5	0.9	1.4
19	1.9	3.8	5.7	7.6	9.5	11.4	13.3	15.2	17.1	19.0	0.5	1.0	1.4
20	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	0.5	1.0	1.5
21	2.1	4.2	6.3	8.4	10.5	12.6	14.7	16.8	18.9	21.0	0.5	1.1	1.6
22	2.2	4.4	6.6	8.8	11.0	13.2	15.4	17.6	19.8	22.0	0.6	1.1	1.7
23	2.3	4.6	6.9	9.2	11.5	13.8	16.1	18.4	20.7	23.0	0.6	1.2	1.7
24	2.4	4.8	7.2	9.6	12.0	14.4	16.8	19.2	21.6	24.0	0.6	1.2	1.8
25	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0	0.6	1.3	1.9
26	2.6	5.2	7.8	10.4	13.0	15.6	18.2	20.8	23.4	26.0	0.7	1.3	2.0
27	2.7	5.4	8.1	10.8	13.5	16.2	18.9	21.6	24.3	27.0	0.7	1.4	2.0
28	2.8	5.6	8.4	11.2	14.0	16.8	19.6	22.4	25.2	28.0	0.7	1.4	2.1
29	2.9	5.8	8.7	11.6	14.5	17.4	20.3	23.2	26.1	29.0	0.7	1.5	2.2
30	3.0	6.0	9.0	12.0	15.0	18.0	21.0	24.0	27.0	30.0	0.8	1.5	2.3
31	3.1	6.2	9.3	12.4	15.5	18.6	21.7	24.8	27.9	31.0	0.8	1.6	2.3
32	3.2	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8	32.0	0.8	1.6	2.4
33	3.3	6.6	9.9	13.2	16.5	19.8	23.1	26.4	29.7	33.0	0.8	1.7	2.5
34	3.4	6.8	10.2	13.6	17.0	20.4	23.8	27.2	30.6	34.0	0.9	1.7	2.6
35	3.5	7.0	10.5	14.0	17.5	21.0	24.5	28.0	31.5	35.0	0.9	1.8	2.6
36	3.6	7.2	10.8	14.4	18.0	21.6	25.2	28.8	32.4	36.0	0.9	1.8	2.7
37	3.7	7.4	11.1	14.8	18.5	22.2	25.9	29.6	33.3	37.0	0.9	1.9	2.8
38	3.8	7.6	11.4	15.2	19.0	22.8	26.6	30.4	34.2	38.0	1.0	1.9	2.9
39	3.9	7.8	11.7	15.6	19.5	23.4	27.3	31.2	35.1	39.0	1.0	2.0	2.9
40	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	36.0	40.0	1.0	2.0	3.0
41	4.1	8.2	12.3	16.4	20.5	24.6	28.7	32.8	36.9	41.0	1.0	2.1	3.1
42	4.2	8.4	12.6	16.8	21.0	25.2	29.4	33.6	37.8	42.0	1.1	2.1	3.2
43	4.3	8.6	12.9	17.2	21.5	25.8	30.1	34.4	38.7	43.0	1.1	2.2	3.2
44	4.4	8.8	13.2	17.6	22.0	26.4	30.8	35.2	39.6	44.0	1.1	2.2	3.3
45	4.5	9.0	13.5	18.0	22.5	27.0	31.5	36.0	40.5	45.0	1.1	2.3	3.4
46	4.6	9.2	13.8	18.4	23.0	27.6	32.2	36.8	41.4	46.0	1.2	2.3	3.5
47	4.7	9.4	14.1	18.8	23.5	28.2	32.9	37.6	42.3	47.0	1.2	2.4	3.5
48	4.8	9.6	14.4	19.2	24.0	28.8	33.6	38.4	43.2	48.0	1.2	2.4	3.6
49	4.9	9.8	14.7	19.6	24.5	29.4	34.3	39.2	44.1	49.0	1.2	2.5	3.7
50	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	1.3	2.5	3.8

REDUCTION OF TIME

REDUCTION OF LOCAL MEAN TIME OF A PLACE INTO THE INDIAN STANDARD TIME

A-CORRECTION TO BE ADDED TO L.M.T. TO OBTAIN I.S.T.

	LONGITUDE OF PLACE (EAST OF GREENWICH)															
	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°
	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
0	62.0	58.0	54.0	50.0	46.0	42.0	38.0	34.0	30.0	26.0	22.0	18.0	14.0	10.0	6.0	2.0
3	61.8	57.8	53.8	49.8	45.8	41.8	37.8	33.8	29.8	25.8	21.8	17.8	13.8	9.8	5.8	1.8
6	61.6	57.6	53.6	49.6	45.6	41.6	37.6	33.6	29.6	25.6	21.6	17.6	13.6	9.6	5.6	1.6
9	61.4	57.4	53.4	49.4	45.4	41.4	37.4	33.4	29.4	25.4	21.4	17.4	13.4	9.4	5.4	1.4
12	61.2	57.2	53.2	49.2	45.2	41.2	37.2	33.2	29.2	25.2	21.2	17.2	13.2	9.2	5.2	1.2
15	61.0	57.0	53.0	49.0	45.0	41.0	37.0	33.0	29.0	25.0	21.0	17.0	13.0	9.0	5.0	1.0
18	60.8	56.8	52.8	48.8	44.8	40.8	36.8	32.8	28.8	24.8	20.8	16.8	12.8	8.8	4.8	0.8
21	60.6	56.6	52.6	48.6	44.6	40.6	36.6	32.6	28.6	24.6	20.6	16.6	12.6	8.6	4.6	0.6
24	60.4	56.4	52.4	48.4	44.4	40.4	36.4	32.4	28.4	24.4	20.4	16.4	12.4	8.4	4.4	0.4
27	60.2	56.2	52.2	48.2	44.2	40.2	36.2	32.2	28.2	24.2	20.2	16.2	12.2	8.2	4.2	0.2
30	60.0	56.0	52.0	48.0	44.0	40.0	36.0	32.0	28.0	24.0	20.0	16.0	12.0	8.0	4.0	0.0
33	59.8	55.8	51.8	47.8	43.8	39.8	35.8	31.8	27.8	23.8	19.8	15.8	11.8	7.8	3.8	
36	59.6	55.6	51.6	47.6	43.6	39.6	35.6	31.6	27.6	23.6	19.6	15.6	11.6	7.6	3.6	
39	59.4	55.4	51.4	47.4	43.4	39.4	35.4	31.4	27.4	23.4	19.4	15.4	11.4	7.4	3.4	
42	59.2	55.2	51.2	47.2	43.2	39.2	35.2	31.2	27.2	23.2	19.2	15.2	11.2	7.2	3.2	
45	59.0	55.0	51.0	47.0	43.0	39.0	35.0	31.0	27.0	23.0	19.0	15.0	11.0	7.0	3.0	
48	58.8	54.8	50.8	46.8	42.8	38.8	34.8	30.8	26.8	22.8	18.8	14.8	10.8	6.8	2.8	
51	58.6	54.6	50.6	46.6	42.6	38.6	34.6	30.6	26.6	22.6	18.6	14.6	10.6	6.6	2.6	
54	58.4	54.4	50.4	46.4	42.4	38.4	34.4	30.4	26.4	22.4	18.4	14.4	10.4	6.4	2.4	
57	58.2	54.2	50.2	46.2	42.2	38.2	34.2	30.2	26.2	22.2	18.2	14.2	10.2	6.2	2.2	
60	58.0	54.0	50.0	46.0	42.0	38.0	34.0	30.0	26.0	22.0	18.0	14.0	10.0	6.0	2.0	

B- CORRECTION TO BE SUBTRACTED FROM L.M.T. TO OBTAIN I.S.T.

	LONGITUDE OF PLACE (EAST OF GREENWICH)															
	82°	83°	84°	85°	86°	87°	88°	89°	90°	91°	92°	93°	94°	95°	96°	97°
	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
0		2.0	6.0	10.0	14.0	18.0	22.0	26.0	30.0	34.0	38.0	42.0	46.0	50.0	54.0	58.0
3		2.2	6.2	10.2	14.2	18.2	22.2	26.2	30.2	34.2	38.2	42.2	46.2	50.2	54.2	58.2
6		2.4	6.4	10.4	14.4	18.4	22.4	26.4	30.4	34.4	38.4	42.4	46.4	50.4	54.4	58.4
9		2.6	6.6	10.6	14.6	18.6	22.6	26.6	30.6	34.6	38.6	42.6	46.6	50.6	54.6	58.6
12		2.8	6.8	10.8	14.8	18.8	22.8	26.8	30.8	34.8	38.8	42.8	46.8	50.8	54.8	58.8
15		3.0	7.0	11.0	15.0	19.0	23.0	27.0	31.0	35.0	39.0	43.0	47.0	51.0	55.0	59.0
18		3.2	7.2	11.2	15.2	19.2	23.2	27.2	31.2	35.2	39.2	43.2	47.2	51.2	55.2	59.2
21		3.4	7.4	11.4	15.4	19.4	23.4	27.4	31.4	35.4	39.4	43.4	47.4	51.4	55.4	59.4
24		3.6	7.6	11.6	15.6	19.6	23.6	27.6	31.6	35.6	39.6	43.6	47.6	51.6	55.6	59.6
27		3.8	7.8	11.8	15.8	19.8	23.8	27.8	31.8	35.8	39.8	43.8	47.8	51.8	55.8	59.8
30	0.0	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0
33	0.2	4.2	8.2	12.2	16.2	20.2	24.2	28.2	32.2	36.2	40.2	44.2	48.2	52.2	56.2	60.2
36	0.4	4.4	8.4	12.4	16.4	20.4	24.4	28.4	32.4	36.4	40.4	44.4	48.4	52.4	56.4	60.4
39	0.6	4.6	8.6	12.6	16.6	20.6	24.6	28.6	32.6	36.6	40.6	44.6	48.6	52.6	56.6	60.6
42	0.8	4.8	8.8	12.8	16.8	20.8	24.8	28.8	32.8	36.8	40.8	44.8	48.8	52.8	56.8	60.8
45	1.0	5.0	9.0	13.0	17.0	21.0	25.0	29.0	33.0	37.0	41.0	45.0	49.0	53.0	57.0	61.0
48	1.2	5.2	9.2	13.2	17.2	21.2	25.2	29.2	33.2	37.2	41.2	45.2	49.2	53.2	57.2	61.2
51	1.4	5.4	9.4	13.4	17.4	21.4	25.4	29.4	33.4	37.4	41.4	45.4	49.4	53.4	57.4	61.4
54	1.6	5.6	9.6	13.6	17.6	21.6	25.6	29.6	33.6	37.6	41.6	45.6	49.6	53.6	57.6	61.6
57	1.8	5.8	9.8	13.8	17.8	21.8	25.8	29.8	33.8	37.8	41.8	45.8	49.8	53.8	57.8	61.8
60	2.0	6.0	10.0	14.0	18.0	22.0	26.0	30.0	34.0	38.0	42.0	46.0	50.0	54.0	58.0	62.0

Sunrise and Sunset

The local mean times of Sunrise and Sunset for latitudes 0° to 60° North at intervals of 4 days during the year have been given on pages 280 to 287. The timings relate to the visibility of the upper limb of the Sun on the horizon. From these tables the L.M.T. of rise or set for any day of the year and for any latitude of place can be obtained by simple interpolation. If the place is in the southern hemisphere, the corrections given on pages 290 to 291 will then have to be applied to the timings for the corresponding northern latitude. For a station in India, the timings of Sunrise and Sunset so obtained which are in L.M.T. can be reduced to I.S.T. by applying the correction given on page 314 according to the longitude of the station.

In addition to the above details given in the publication, the timings of Sunrise and Sunset of five important cities of India, viz., Kolkata, Varanasi, Chennai, Delhi and Mumbai have been specially calculated and given in I.S.T. on pages 292 to 295.

Sunrise and Sunset for Southern Latitudes

The timings of Sunrise and Sunset for southern latitudes, which have not been tabulated separately, can be deduced from those for the corresponding northern latitudes by applying the corrections given on pages 290 and 291.

Twilight

The timings of the beginning of morning twilight and ending of evening twilight have been given for latitudes 0° to 60° North on pages 280 to 287. The timings relate to the instant when the center of the Sun is 18° below the horizon. This is now known as astronomical twilight. The period of twilight has been divided into three parts - Civil when the Sun is 6° below the horizon, Nautical when 12° and Astronomical when 18° - and their durations have been given separately on pages 288 and 289 at an interval of 8 days. The figures for any intermediate date can be worked out from the tables by simple interpolation.

Moonrise and Moonset

The local mean times of Moonrise and Moonset for latitudes 0° to 50° North at 10- degrees interval together with the timings of these events in I.S.T. for four important stations in India, Viz., Kolkata, Chennai, Delhi and Mumbai for each day of the year have been given on pages 296 to 311 along with some supplementary tables on pages 312 to 313. A detailed method of calculation for any station is given below.

To find the time of Moonrise and Moonset for any station the figure for the phenomena concerned given against the date is to be taken from the table (pages 296 to 311) for the latitude just lower than the latitude of the station, to which the following corrections will have to be applied :

(a) Correction for difference in latitude;
(b) Correction for longitude, if the place is not on the Central Meridian of India (i.e., 82°.5 E. Long);
(c) Correction for converting L.M.T. into I.S.T., when and where necessary.

These corrections are detailed below :

(a) Correction for difference in latitude - The timings of Moonrise and Moonset have been given for latitudes 0°, 10°, 20°, 30°, 40° and 50° North, and in local mean time. The timing for any particular latitude of place falling within the above limits can be obtained by simple interpolation between figures for the two latitudes, one below and the other above the latitude of the given place. For this purpose the table on page 313 can be conveniently used wherein corrections for latitude are shown according to the variation per 10° of latitude of the timings of Moonrise or Moonset distributed over each degree of latitude. The correction can also be calculated directly by multiplying one-tenth of the time difference between the figures for two consecutive given latitudes by the excess of the latitude of the station over the given lower latitude.

(b) Correction for difference in longitude - The timings thus obtained are exact for the Central Meridian of India, i.e, for longitude $82^\circ.5$ East of Greenwich. For other longitudes the correction given on page 312 should be applied according to :

(i) the longitude of the station, and
(ii) the daily variation of the timings of rising or setting, as the case may be, between two consecutive dates.

If greater accuracy is not required, the daily variation may be assumed to be a constant (i.e., 50 minutes) for all dates and corrections from the following table may be applied instead of taking the corrections from the table on page 312.

Longitude of Station (East)	Correction m	Longitude of Station (East)	Correction m
0°	+ 11.5	84°	- 0.2
30°	+ 7.3	88°	- 0.8
60°	+ 3.1	92°	- 1.3
68°	+ 2.0	96°	- 1.9
72°	+ 1.5	120°	- 5.2
76°	+ 0.9	150°	- 9.4
80°	+ 0.3	180°	- 13.5

The timing thus obtained by the above two operations is in L.M.T. of the station

(c) Correction for converting L.M.T. into I.S.T. - The figures obtained by the operations (a) and (b) above would give the local mean time of Moonrise or Moonset for the given station. The local mean time can be reduced to the Indian Standard Time by the help of the reduction table on page 314. In other way to obtain the I.S.T., the L.M.T. may be increased at the rate of 4 minutes per degree of longitude if the station is to the west of $82^\circ.5$ East and decreased at the same rate if the station is to the east of $82^\circ.5$ East Longitude.

In practice, however, when dealing with the same station, it will be convenient to combine corrections (b) and (c) above, as these are constant day after day, and add this constant to the daily times corrected for latitude only.

Moonrise and Moonset for southern Latitudes

The times of Moonrise and Moonset for southern latitudes have not been given separately. The timings for a station in southern latitude can, however, be deduced from those for the corresponding northern latitude by the following formula :

Timings for a southern latitude = $2 \times$ Timing for 0° latitude - Timing for the same northern latitude.

In this case the local mean time for the same latitude north will have to be calculated first by applying the latitude correction (a) above, and the corresponding time for the southern latitude will have to be deduced by the above formula by utilising the published figure for 0° latitude. The exact L.M.T. of rising or setting for the place in question will, however, be obtained by applying the correction (b) above to the time so deduced.

If necessary, the timings thus obtained may be reduced to I.S.T. by the usual method.

PHASES OF THE MOON, 2019

(Time in I.S.T.)

		d	h	m			d	h	m
Full Moon	Dec, 18	22	23	19	Full Moon	Jul	17	03	08
Last Quarter	Dec, 18	29	15	04	Last Quarter	Jul	25	06	48
New Moon	Jan, 19	06	06	58	New Moon	Aug	01	08	42
First Quarter	Jan	14	12	16	First Quarter	Aug	07	23	01
Full Moon	Jan	21	10	46	Full Moon	Aug	15	17	59
Last Quarter	Jan	28	02	40	Last Quarter	Aug	23	20	26
New Moon	Feb	05	02	34	New Moon	Aug	30	16	07
First Quarter	Feb	13	03	56	First Quarter	Sep	06	08	40
Full Moon	Feb	19	21	24	Full Moon	Sep	14	10	03
Last Quarter	Feb	26	16	58	Last Quarter	Sep	22	08	11
New Moon	Mar	06	21	34	New Moon	Sep	28	23	56
First Quarter	Mar	14	15	57	First Quarter	Oct	05	22	17
Full Moon	Mar	21	07	13	Full Moon	Oct	14	02	38
Last Quarter	Mar	28	09	40	Last Quarter	Oct	21	18	09
New Moon	Apr	05	14	20	New Moon	Oct	28	09	08
First Quarter	Apr	13	00	36	First Quarter	Nov	04	15	53
Full Moon	Apr	19	16	42	Full Moon	Nov	12	19	04
Last Quarter	Apr	27	03	48	Last Quarter	Nov	20	02	41
New Moon	May	05	04	15	New Moon	Nov	26	20	36
First Quarter	May	12	06	42	First Quarter	Dec	04	12	28
Full Moon	May	19	02	41	Full Moon	Dec	12	10	42
Last Quarter	May	26	22	04	Last Quarter	Dec	19	10	27
New Moon	Jun	03	15	32	New Moon	Dec	26	10	43
First Quarter	Jun	10	11	29	First Quarter	Jan, 20	03	10	15
Full Moon	Jun	17	14	01	Full Moon	Jan, 20	11	00	51
Last Quarter	Jun	25	15	16	Last Quarter	Jan, 20	17	18	28
New Moon	Jul	03	00	46	New Moon	Jan, 20	25	03	12
First Quarter	Jul	09	16	25	First Quarter	Feb, 20	02	07	12

PART - IV

ECLIPSES, TRANSIT AND OCCULTATIONS

ECLIPSES, 2019

In the year 2019, there are three eclipses of the Sun, two eclipses of the Moon and a transit of Mercury.

I	January	5-6	Partial eclipse of the Sun	320-322
II	January	21	Total Eclipse of the Moon	337
III	July	2	Total eclipse of the Sun	323-326
IV	July	16-17	Partial eclipse of the Moon	338
V	November	11	Transit of Mercury	339-340
VI	December	26	Annular Eclipse of the Sun	327-336

I- Partial eclipse of the Sun, January 5-6, 2019, Saturday-Sunday.

Not visible in India.

Area of Visibility

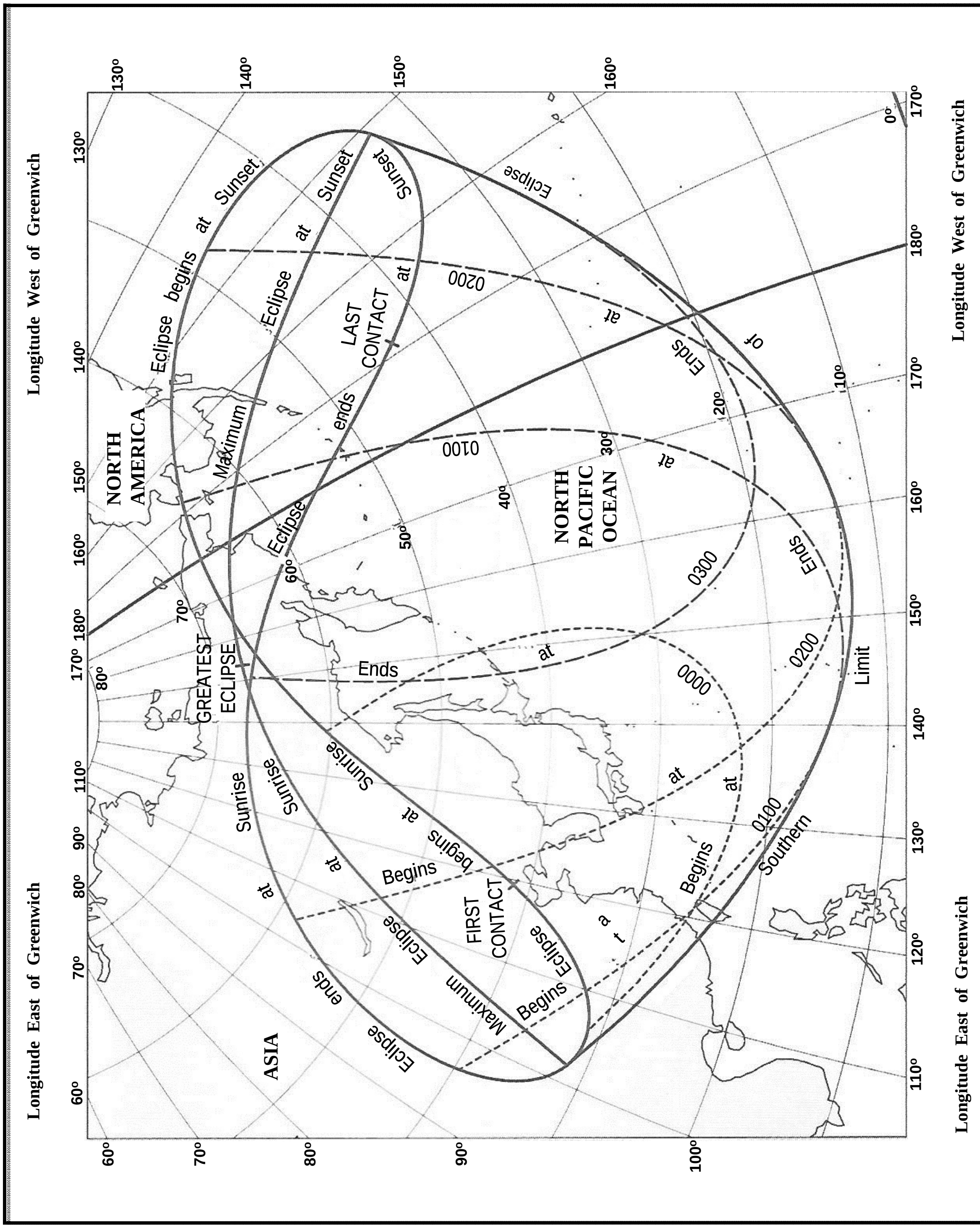
The eclipse is visible in the region covering north eastern China, Mongolia, Japan, eastern Russia, north and westernmost Alaska.

ELEMENTS OF THE ECLIPSE						
Universal Time of Conjunction in Right Ascension : January 6^d 1^h 43^m $42^s.18$						
	MOON			SUN		
	h	m	s	h	m	s
Right Ascension	19	06	57.77	19	06	57.77
Hourly Motion			129.66			10.97
	°	'	"	°	'	"
Declination	-21	30	34.21	-22	32	35.92
Hourly Motion		0	42.47			17.50
Equatorial Horizontal Parallax		54	27.60			08.94
True Semi-diameter		14	50.06		16	15.93

CIRCUMSTANCES OF THE ECLIPSE										
	Universal Time			Indian Standard Time			Latitude		Longitude	
	d	h	m	d	h	m	°	'	°	'
Eclipse begins	5	23	34.3	6	05	04.3	41	32.6	+119	23.4
Greatest eclipse*	6	01	41.5	6	07	11.5	67	26.1	153	34.1
Eclipse ends	6	03	48.7	6	09	18.7	43	09.5	-168	40.5

*Magnitude of the eclipse =0.714

PARTIAL SOLAR ECLIPSE OF JANUARY 5-6, 2019



The timings of beginning and ending are expressed in UT

ECLIPSES, 2019

BESSELIAN ELEMENTS OF THE PARTIAL ECLIPSE OF THE SUN
JANUARY 5-6

Terrestrial Time (TT)		Co-ordinates of the Centre of Shadow on the Fundamental Plane		Direction of the Axis of Shadow *					Radius of Penumbra and Umbra on the Fundamental Plane
h	m	x	y	sin d	cos d	μ °	'	"	l_1
23	00	-1.396338	+1.119685	-0.383641	+0.923482	163	37	30.0	+0.571448
	10	-1.311641	+1.120989	-0.383628	+0.923488	166	07	28.1	+0.571467
	20	-1.226943	+1.122298	-0.383615	+0.923493	168	37	26.1	+0.571485
	30	-1.142243	+1.123612	-0.383602	+0.923498	171	07	24.1	+0.571504
	40	-1.057542	+1.124933	-0.383590	+0.923504	173	37	22.2	+0.571521
	50	-0.972839	+1.126260	-0.383577	+0.923509	176	07	20.2	+0.571538
00	00	-0.888136	+1.127592	-0.383564	+0.923514	178	37	18.2	+0.571555
	10	-0.803432	+1.128930	-0.383551	+0.923520	181	07	16.3	+0.571571
	20	-0.718727	+1.130274	-0.383538	+0.923525	183	37	14.3	+0.571586
	30	-0.634021	+1.131624	-0.383525	+0.923531	186	07	12.3	+0.571601
	40	-0.549315	+1.132980	-0.383512	+0.923536	188	37	10.4	+0.571615
	50	-0.464609	+1.134342	-0.383499	+0.923541	191	07	08.4	+0.571629
01	00	-0.379903	+1.135710	-0.383486	+0.923547	193	37	06.4	+0.571642
	10	-0.295198	+1.137083	-0.383473	+0.923552	196	07	04.5	+0.571655
	20	-0.210492	+1.138463	-0.383460	+0.923558	198	37	02.5	+0.571667
	30	-0.125787	+1.139848	-0.383447	+0.923563	201	07	00.6	+0.571678
	40	-0.041083	+1.141240	-0.383434	+0.923568	203	36	58.6	+0.571689
	50	+0.043621	+1.142637	-0.383421	+0.923574	206	06	56.6	+0.571700
02	00	+0.128323	+1.144041	-0.383408	+0.923579	208	36	54.7	+0.571710
	10	+0.213025	+1.145450	-0.383395	+0.923585	211	06	52.7	+0.571719
	20	+0.297724	+1.146865	-0.383382	+0.923590	213	36	50.7	+0.571728
	30	+0.382423	+1.148286	-0.383369	+0.923595	216	06	48.8	+0.571736
	40	+0.467120	+1.149714	-0.383356	+0.923601	218	36	46.8	+0.571744
	50	+0.551814	+1.151147	-0.383343	+0.923606	221	06	44.8	+0.571751
03	00	+0.636507	+1.152586	-0.383330	+0.923612	223	36	42.9	+0.571758
	10	+0.721198	+1.154032	-0.383317	+0.923617	226	06	40.9	+0.571765
	20	+0.805886	+1.155483	-0.383304	+0.923622	228	36	38.9	+0.571770
	30	+0.890571	+1.156940	-0.383290	+0.923628	231	06	37.0	+0.571776
	40	+0.975254	+1.158404	-0.383277	+0.923633	233	36	35.0	+0.571780
	50	+1.059934	+1.159873	-0.383264	+0.923639	236	06	33.1	+0.571785
04	00	+1.144611	+1.161349	-0.383251	+0.923644	238	36	31.1	+0.571788
	10	+1.229285	+1.162830	-0.383238	+0.923649	241	06	29.1	+0.571792
	20	+1.313955	+1.164318	-0.383225	+0.923655	243	36	27.2	+0.571794
	30	+1.398622	+1.165812	-0.383212	+0.923660	246	06	25.2	+0.571797
	40	+1.483284	+1.167312	-0.383199	+0.923666	248	36	23.2	+0.571798

tanf1= 0.00476388 tanf2= 0.00474018

TT	d			Variations per minute			
hr	°	'	"	x'	y'	μ' '	"
23	-22	33	34	+0.008 470	+0.000 130	15	00
00	-22	33	17	+0.008 470	+0.000 134	15	00
01	-22	32	59	+0.008 471	+0.000 137	15	00
02	-22	32	42	+0.008 470	+0.000 141	15	00
03	-22	32	24	+0.008 469	+0.000 145	15	00
04	-22	32	07	+0.008 467	+0.000 148	15	

$\xi' = 0.004364\ \rho\cos\phi'\cos(\mu+\lambda)$ $\eta' = 0.004364\ \xi\sin d$

*d stands for declination and μ stands for hour angle

ECLIPSES, 2019

III-Total Eclipse of the Sun, July 2, 2019, Tuesday

Not visible in India

Area of Visibility

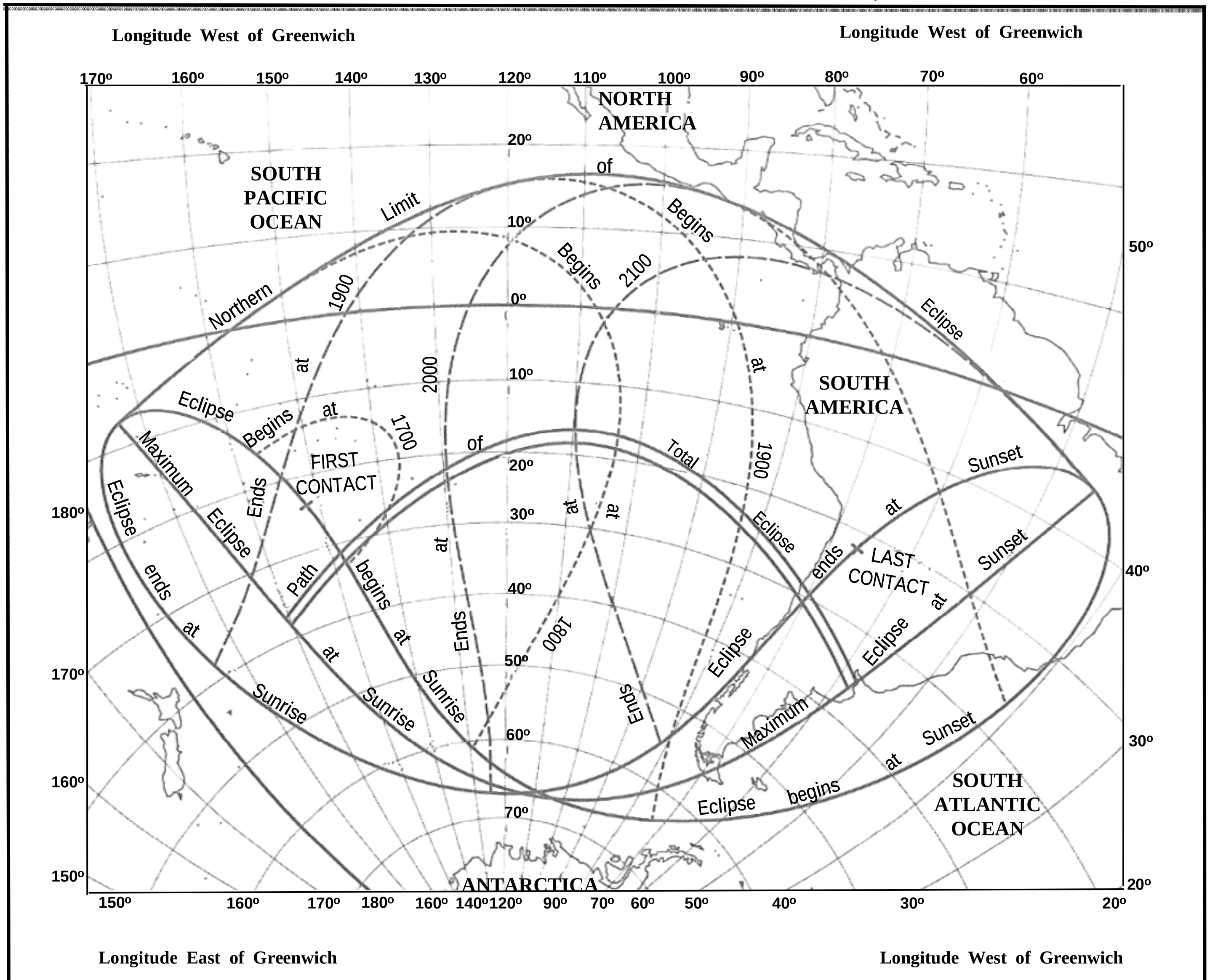
The eclipse is visible in the region covering South America, South Central America and the south Pacific Ocean.

ELEMENTS OF THE ECLIPSE						
Universal Time of Conjunction in Right Ascension : July 2^d 19^h 21^m $41^s.23$						
	MOON			SUN		
	h	m	s	h	m	s
Right Ascension	06	46	14.54	06	46	14.54
Hourly Motion			156.03			10.33
	°	'	"	°	'	"
Declination	22	22	07.56	23	00	36.65
Hourly Motion			24.26			-11.40
Equatorial Horizontal Parallax		59	37.74			8.65
True Semi-diameter		16	14.53		15	43.84

CIRCUMSTANCES OF THE ECLIPSE										
	Universal Time			Indian Standard Time			Latitude		Longitude	
	d	h	m	d	h	m	°	'	°	'
Eclipse begins	2	16	55.3	2	22	25.3	-23	53.9	-151	57.7
Central eclipse begins	2	18	02.3	2	23	32.3	-37	39.5	-160	25.7
Greatest eclipse*	2	19	23.0	3	00	53.0	-17	23.4	-109	00.0
Central eclipse ends	2	20	43.6	3	02	13.6	-35	47.6	-57	42.8
Eclipse ends	2	21	50.6	3	03	20.6	-21	58.2	-66	28.9

*Magnitude of the eclipse = 1.0456, Maximum duration of total phase = 4 min 38 s

TOTAL SOLAR ECLIPSE OF JULY 2, 2019



The timings of beginning and ending are expressed in UT

ECLIPSES, 2019

BESSELIAN ELEMENTS OF THE TOTAL ECLIPSE OF THE SUN
JULY 2

Terrestrial Time (TT)		Co-ordinates of the Centre of Shadow on the Fundamental Plane		Direction of the Axis of Shadow *					Radius of Penumbra and Umbra on the Fundamental Plane	
h	m	x	y	sin d	cos d	μ °	'	"	l_1	l_2
16	40	-1.536526	-0.676228	+0.391058	+0.920366	68	58	50.9	+0.536901	-0.008120
	50	-1.442202	-0.674359	+0.391050	+0.920370	71	28	50.6	+0.536895	-0.008126
17	00	-1.347873	-0.672498	+0.391041	+0.920373	73	58	50.3	+0.536888	-0.008133
	10	-1.253540	-0.670644	+0.391033	+0.920377	76	28	50.0	+0.536881	-0.008140
	20	-1.159203	-0.668797	+0.391024	+0.920380	78	58	49.7	+0.536873	-0.008148
	30	-1.064862	-0.666958	+0.391016	+0.920384	81	28	49.4	+0.536864	-0.008157
	40	-0.970517	-0.665125	+0.391007	+0.920388	83	58	49.1	+0.536855	-0.008166
	50	-0.876170	-0.663299	+0.390999	+0.920391	86	28	48.8	+0.536845	-0.008176
	00	-0.781819	-0.661480	+0.390990	+0.920395	88	58	48.5	+0.536835	-0.008186
18	10	-0.687465	-0.659668	+0.390982	+0.920398	91	28	48.2	+0.536824	-0.008197
	20	-0.593108	-0.657864	+0.390973	+0.920402	93	58	47.9	+0.536812	-0.008209
	30	-0.498749	-0.656066	+0.390965	+0.920406	96	28	47.6	+0.536800	-0.008221
	40	-0.404389	-0.654276	+0.390956	+0.920409	98	58	47.3	+0.536787	-0.008234
	50	-0.310026	-0.652493	+0.390948	+0.920413	101	28	47.0	+0.536773	-0.008248
19	00	-0.215661	-0.650717	+0.390939	+0.920417	103	58	46.7	+0.536759	-0.008262
	10	-0.121296	-0.648948	+0.390931	+0.920420	106	28	46.4	+0.536744	-0.008277
	20	-0.026929	-0.647186	+0.390922	+0.920424	108	58	46.1	+0.536728	-0.008293
	30	+0.067439	-0.645431	+0.390914	+0.920427	111	28	45.8	+0.536712	-0.008309
	40	+0.161807	-0.643683	+0.390905	+0.920431	113	58	45.5	+0.536695	-0.008326
	50	+0.256176	-0.641943	+0.390896	+0.920435	116	28	45.2	+0.536678	-0.008343
20	00	+0.350545	-0.640209	+0.390888	+0.920438	118	58	44.9	+0.536660	-0.008361
	10	+0.444914	-0.638483	+0.390879	+0.920442	121	28	44.7	+0.536641	-0.008380
	20	+0.539282	-0.636764	+0.390871	+0.920446	123	58	44.4	+0.536622	-0.008399
	30	+0.633650	-0.635052	+0.390862	+0.920449	126	28	44.1	+0.536602	-0.008419
	40	+0.728017	-0.633347	+0.390854	+0.920453	128	58	43.8	+0.536581	-0.008440
	50	+0.822383	-0.631650	+0.390845	+0.920457	131	28	43.5	+0.536560	-0.008461
21	00	+0.916747	-0.629959	+0.390836	+0.920460	133	58	43.2	+0.536538	-0.008483
	10	+1.011110	-0.628276	+0.390828	+0.920464	136	28	42.9	+0.536515	-0.008506
	20	+1.105471	-0.626600	+0.390819	+0.920468	138	58	42.6	+0.536492	-0.008529
	30	+1.199831	-0.624931	+0.390811	+0.920471	141	28	42.3	+0.536468	-0.008553
	40	+1.294187	-0.623270	+0.390802	+0.920475	143	58	42.0	+0.536443	-0.008578
	50	+1.388541	-0.621615	+0.390793	+0.920479	146	28	41.7	+0.536418	-0.008603
22	00	+1.482893	-0.619968	+0.390785	+0.920482	148	58	41.4	+0.536392	-0.008629
	10	+1.577241	-0.618328	+0.390776	+0.920486	151	28	41.1	+0.536366	-0.008655
	20	+1.671586	-0.616696	+0.390768	+0.920490	153	58	40.8	+0.536339	-0.008682

tanf1= 0.00460580 tanf2= 0.00458289

TT hr	d °	'	"	Variations per minute x'	y'	μ' '	"
17	23	01	09	+0.009 433	0.000 185	15	00
18	23	00	58	+0.009 435	0.000 181	15	00
19	23	00	47	+0.009 437	0.000 173	15	00
20	23	00	35	+0.009 437	0.000 173	15	00
21	23	00	24	+0.009 436	0.000 168	15	00
2	23	00	12	+0.009 435	0.000 164	15	00

$\xi' = 0.004364\ \rho\cos\phi'\cos(\mu+\lambda)$ $\eta' = 0.004364\ \xi\sin d$

*d stands for declination and μ stands for hour angle

ECLIPSES, 2019

PATH OF CENTRAL PHASE DURING THE TOTAL ECLIPSE OF THE SUN
JULY 2

Terrestrial Time (TT)	Northern Limit		Central Line		Southern Limit		Central Line
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Duration of totality
	° '	° '	° '	° '	° '	° '	m s
Limit	-37 06.1	-160 40.2	-37 39.5	-160 25.7	-38 13.1	-160 10.9	-------
h m							
18 10	-27 54.5	-141 36.0	-28 01.6	-142 00.6	-29 50.1	-142 28.4	2 43
20	24 03.1	133 44.4	24 55.7	133 53.9	25 49.0	134 04.6	3 12
30	21 32.6	128 15.0	22 24.3	128 18.9	23 16.5	128 23.6	3 34
40	19 44.5	123 48.8	20 36.3	123 49.8	21 28.5	123 51.4	3 52
18 50	-18 25.5	-119 57.8	-19 17.6	-119 57.1	-20 10.1	-119 56.9	4 06
19 00	-17 29.1	-116 27.8	-18 21.7	-116 26.2	-19 14.6	-116 24.9	4 17
10	16 52.1	113 10.3	17 45.0	113 08.2	18 38.3	113 06.2	4 25
20	16 32.6	109 59.1	17 25.9	109 56.6	18 19.4	109 54.2	4 28
30	16 29.9	106 49.2	17 23.4	106 46.4	18 17.1	106 43.6	4 28
40	16 44.3	103 35.8	17 37.8	103 32.6	18 31.6	103 29.3	4 24
50	-17 16.7	-100 13.5	-18 10.1	-100 09.7	-19 03.9	-100 05.6	4 16
20 00	-18 09.3	-96 35.4	-19 02.7	-96 30.5	-19 56.5	-96 25.2	4 04
10	19 26.4	92 31.4	20 19.9	92 24.6	21 13.8	92 17.0	3 49
20	21 16.3	87 43.7	22 10.2	87 33.2	23 04.7	87 21.6	3 29
30	23 57.6	81 32.8	24 53.5	81 14.2	25 50.3	80 53.6	3 05
20 40	-28 40.2	-71 32.0	-29 48.0	-70 41.1	-30 59.4	-69 41.4	2 31
Limit	-35 12.9	-57 28.9	-35 47.6	-57 42.7	-36 22.6	-57 56.7	-------

ECLIPSES, 2019

VI-Annular Eclipse of the Sun, December 26, 2019, Thursday

Visible in India

Area of Visibility

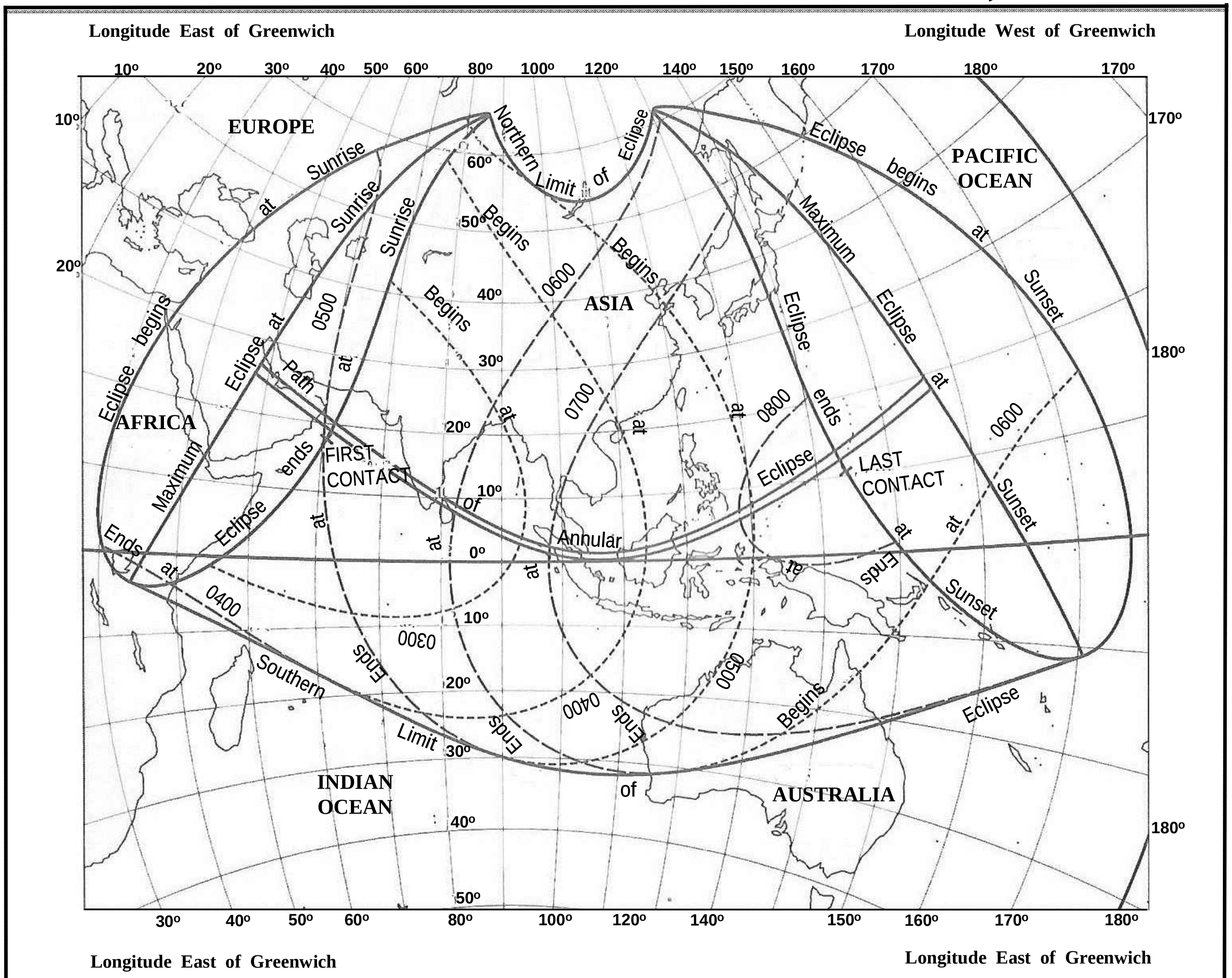
The Eclipse will be visible in the region covering Middle East, North Eastern Africa, Asia except North and Eastern Russia, North and Western Australia, Solomon Island.

ELEMENTS OF THE ECLIPSE						
Universal Time of Conjunction in Right Ascension : December 26^d 5^h 14^m $35^s.04$						
	MOON			SUN		
	h	m	s	h	m	s
Right Ascension	18	17	56.15	18	17	56.15
Hourly Motion			143.54			11.10
	°	'	"	°	'	"
Declination	-22	58	43.23	-23	22	19.46
Hourly Motion		-1	58.83			4.76
Equatorial Horizontal Parallax		57	04.11			8.94
True Semi-diameter		15	32.69		16	15.75

CIRCUMSTANCES OF THE ECLIPSE										
	Universal Time			Indian Standard Time			Latitude		Longitude	
	d	h	m	d	h	m	°	'	°	'
Eclipse begins	26	02	30.0	26	08	00.0	17	47.8	+60	32.2
Central eclipse begins	26	03	36.1	26	09	06.1	25	59.1	+48	12.1
Greatest eclipse*	26	05	17.7	26	10	47.7	01	00.5	+102	14.9
Central eclipse ends	26	06	59.4	26	12	29.4	18	53.8	+156	42.6
Eclipse ends	26	08	05.6	26	13	35.6	10	37.7	+144	01.6

*Magnitude of the eclipse = 0.969, Maximum duration of Annular phase =3 min 34 s

ANNULAR SOLAR ECLIPSE OF DECEMBER 26, 2019



The timings of beginning and ending are expressed in UT

ECLIPSES, 2019

BESSELIAN ELEMENTS OF THE ANNULAR ECLIPSE OF THE SUN
DECEMBER 26, 2019

Terrestrial Time (TT)		Co-ordinates of the Centre of Shadow on the Fundamental Plane		Direction of the Axis of Shadow *					Radius of Penumbra and Umbra on the Fundamental Plane	
h	m	x	y	sin d	cos d	μ °	'	"	l_1	l_2
2	00	-1.747069	+0.535338	-0.396790	+0.917910	209	56	52.6	+0.557458	+0.012436
	10	-1.657831	+0.529090	-0.396786	+0.917911	212	26	50.4	+0.557490	+0.012468
	20	-1.568589	+0.522849	-0.396782	+0.917913	214	56	48.1	+0.557521	+0.012500
	30	-1.479344	+0.516617	-0.396779	+0.917914	217	26	45.9	+0.557552	+0.012531
	40	-1.390096	+0.510391	-0.396775	+0.917916	219	56	43.7	+0.557582	+0.012561
	50	-1.300844	+0.504174	-0.396771	+0.917918	222	26	41.4	+0.557612	+0.012590
3	00	-1.211589	+0.497964	-0.396768	+0.917919	224	56	39.2	+0.557640	+0.012619
	10	-1.122332	+0.491762	-0.396764	+0.917921	227	26	36.9	+0.557669	+0.012647
	20	-1.033072	+0.485568	-0.396760	+0.917922	229	56	34.7	+0.557696	+0.012675
	30	-0.943810	+0.479382	-0.396756	+0.917924	232	26	32.5	+0.557723	+0.012701
	40	-0.854546	+0.473204	-0.396753	+0.917926	234	56	30.2	+0.557749	+0.012728
	50	-0.765279	+0.467033	-0.396749	+0.917927	237	26	28.0	+0.557774	+0.012753
4	00	-0.676011	+0.460870	-0.396745	+0.917929	239	56	25.7	+0.557799	+0.012778
	10	-0.586741	+0.454715	-0.396742	+0.917930	242	26	23.5	+0.557823	+0.012802
	20	-0.497470	+0.448568	-0.396738	+0.917932	244	56	21.3	+0.557846	+0.012825
	30	-0.408198	+0.442429	-0.396734	+0.917934	247	26	19.0	+0.557869	+0.012848
	40	-0.318924	+0.436298	-0.396730	+0.917935	249	56	16.8	+0.557891	+0.012870
	50	-0.229650	+0.430174	-0.396727	+0.917937	252	26	14.6	+0.557912	+0.012891
5	00	-0.140375	+0.424059	-0.396723	+0.917938	254	56	12.3	+0.557933	+0.012912
	10	-0.051099	+0.417951	-0.396719	+0.917940	257	26	10.1	+0.557953	+0.012932
	20	+0.038177	+0.411852	-0.396715	+0.917942	259	56	07.8	+0.557972	+0.012951
	30	+0.127453	+0.405760	-0.396712	+0.917943	262	26	05.6	+0.557991	+0.012969
	40	+0.216730	+0.399676	-0.396708	+0.917945	264	56	03.4	+0.558008	+0.012987
	50	+0.306005	+0.393601	-0.396704	+0.917947	267	26	01.1	+0.558026	+0.013004
6	00	+0.395281	+0.387533	-0.396700	+0.917948	269	55	58.9	+0.558042	+0.013021
	10	+0.484556	+0.381473	-0.396696	+0.917950	272	25	56.7	+0.558058	+0.013036
	20	+0.573830	+0.375422	-0.396693	+0.917952	274	55	54.4	+0.558073	+0.013051
	30	+0.663103	+0.369378	-0.396689	+0.917953	277	25	52.2	+0.558087	+0.013066
	40	+0.752376	+0.363343	-0.396685	+0.917955	279	55	49.9	+0.558101	+0.013079
	50	+0.841646	+0.357316	-0.396681	+0.917957	282	25	47.7	+0.558113	+0.013092
7	00	+0.930916	+0.351296	-0.396677	+0.917958	284	55	45.5	+0.558126	+0.013104
	10	+1.020183	+0.345285	-0.396673	+0.917960	287	25	43.2	+0.558137	+0.013116
	20	+1.109449	+0.339282	-0.396670	+0.917962	289	55	41.0	+0.558148	+0.013126
	30	+1.198713	+0.333287	-0.396666	+0.917963	292	25	38.8	+0.558158	+0.013136
	40	+1.287975	+0.327301	-0.396662	+0.917965	294	55	36.5	+0.558167	+0.013146
	50	+1.377234	+0.321322	-0.396658	+0.917967	297	25	34.3	+0.558176	+0.013154
8	00	+1.466490	+0.315352	-0.396654	+0.917968	299	55	32.1	+0.558183	+0.013162

tanf1= 0.00476242　　　　tanf2= 0.00473873

TT	d			Variations per minute			
hr	°	'	"	x'	y'	μ' '	"
3	-23	35	35	+0.008 925	-0.000 621	15	00
4	-23	30	30	+0.008 927	-0.000 616	15	00
5	-23	24	24	+0.008 928	-0.000 611	15	00
6	-23	19	19	+0.008 927	-0.000 606	15	00
7	-23	14	14	+0.008 927	-0.000 601	15	00

$\xi' = 0.004364\ \rho\cos\phi'\cos(\mu+\lambda)$　　　　$\eta' = 0.004364\ \xi\sin d$

*d stands for declination and μ stands for hour angle

ECLIPSES, 2019

PATH OF CENTRAL PHASE DURING THE ANNULAR ECLIPSE OF THE SUN
DECEMBER 26

Terrestrial Time (TT)	Northern Limit		Central Line		Southern Limit		Central Line
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Duration of Annularity
	° '	° '	° '	° '	° '	° '	m s
Limit	+26 40.2	+48 29.2	+25 59.1	+48 12.1	+25 18.2	+47 55.1	------
h m							
3 40	+20 29.6	+61 16.0	+19 38.4	+61 24.6	+18 49.3	+61 30.1	3 07
50	+14 57.6	+71 29.9	+14 17.8	+71 23.5	+13 38.8	+71 16.4	3 13
4 00	+11 35.7	+77 30.6	+10 59.6	+77 21.9	+10 23.9	+77 12.7	3 19
10	09 05.8	82 03.7	8 31.5	81 54.5	7 57.6	81 45.0	3 23
20	07 07.5	85 50.7	6 34.3	85 41.7	6 01.5	85 32.4	3 28
30	05 32.2	89 09.8	4 59.7	89 01.2	4 27.5	88 52.4	3 32
40	04 15.2	92 10.8	3 43.0	92 02.7	3 11.2	91 54.6	3 36
50	+03 13.7	+94 59.9	+2 41.6	+94 52.6	+2 09.9	+94 45.2	3 40
5 00	+02 26.1	+97 41.6	+1 54.0	+97 35.1	+1 22.2	+97 28.5	3 42
10	01 51.4	100 19.1	1 19.1	100 13.4	0 47.0	100 07.7	3 44
20	01 29.0	102 55.3	0 56.4	102 50.5	0 24.0	102 45.8	3 45
30	01 18.9	105 32.9	0 45.9	105 29.0	0 13.1	105 25.1	3 46
40	01 21.4	108 14.3	0 47.8	108 11.3	0 14.4	108 08.3	3 45
50	+01 37.0	+111 02.6	+1 02.7	+111 00.5	+0 28.8	+110 58.4	3 43
6 00	+02 07.0	+114 01.5	+1 31.9	+114 00.1	+0 57.2	+113 58.9	3 41
10	02 53.4	117 15.9	2 17.3	117 15.1	1 41.6	117 14.6	3 38
20	03 59.5	120 53.1	3 22.1	120 52.8	2 45.1	120 52.7	3 34
30	05 31.2	125 05.7	4 51.9	125 05.1	4 13.1	125 05.0	3 29
40	07 40.2	130 18.2	6 57.9	130 16.2	6 16.4	130 14.9	3 24
50	+10 58.2	+137 38.1	+10 10.0	+137 30.0	+9 23.0	+137 23.5	3 18
Limit	+19 37.0	+156 26.8	+18 54.0	+156 42.2	+18 11.2	+156 57.6	-------

ECLIPSES, 2019
THE ANNULAR ECLIPSE OF THE SUN, DECEMBER 26
LOCAL CIRCUMSTANCES RELATING TO INDIA

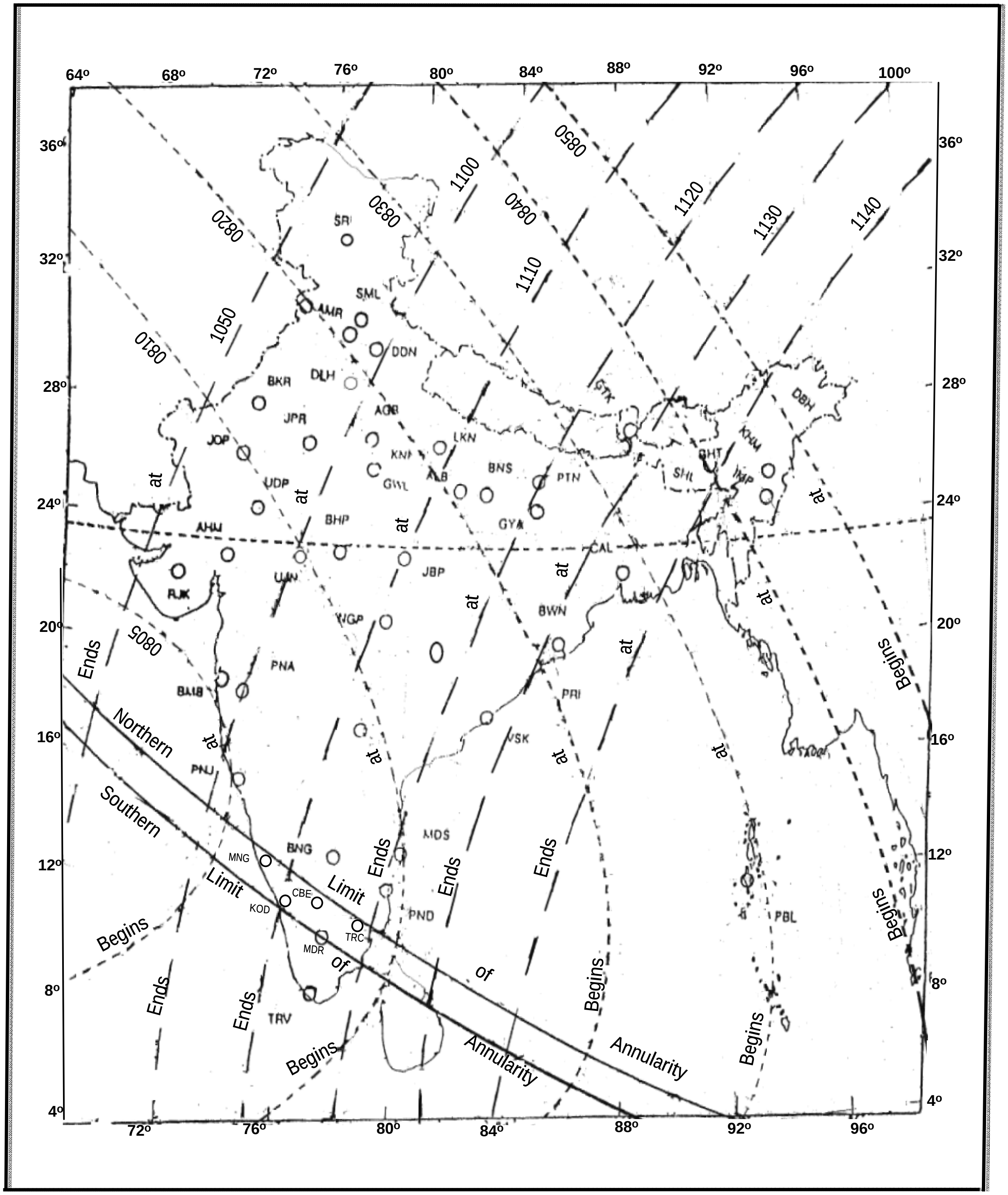
BEGINNING OF ECLIPSE FOR STATIONS IN INDIA
TIME IN I.S.T.

Lat (North)	Longitude East of Greenwich Beginning								
	68°	72°	76°	80°	84°	88°	92°	96°	100°
	h m	h m	h m	h m	h m	h m	h m	h m	h m
36°	8 19.1	8 23.1	8 28.2	8 34.5	8 42.1	8 51.1	9 01.5	9 13.2	9 25.9
32°	8 12.7	8 16.2	8 20.8	8 26.6	8 33.6	8 42.1	8 52.0	9 03.4	9 16.0
28°	8 07.7	8 10.7	8 14.8	8 20.0	8 26.5	8 34.4	8 43.9	8 54.8	9 07.2
24°	8 04.1	8 06.7	8 10.2	8 14.9	8 20.9	8 28.3	8 37.2	8 47.7	8 59.7
20°	8 01.9	8 04.0	8 07.1	8 11.3	8 16.8	8 23.6	8 32.0	8 42.0	8 53.6
16°	8 01.1	8 02.9	8 05.5	8 09.3	8 14.2	8 20.6	8 28.4	8 37.9	8 49.0
12°	8 01.8	8 03.2	8 05.4	8 08.7	8 13.3	8 19.1	8 26.5	8 35.4	8 46.1
8°	8 04.0	8 05.1	8 06.8	8 09.8	8 13.9	8 19.3	8 26.2	8 34.7	8 44.8

ENDING OF ECLIPSE FOR STATIONS IN INDIA
TIME IN I.S.T.

Lat (North)	Longitude East of Greenwich Beginning								
	68°	72°	76°	80°	84°	88°	92°	96°	100°
	h m	h m	h m	h m	h m	h m	h m	h m	h m
36°	10 37.8	10 42.7	10 48.1	10 54.2	11 01.0	11 8.5	11 16.8	11 26.0	11 36.1
32°	10 39.5	10 45.2	10 51.6	10 58.7	11 06.7	11 15.4	11 25.0	11 35.4	11 46.6
28°	10 41.1	10 47.7	10 55.1	11 03.3	11 12.4	11 22.3	11 33.1	11 44.6	11 56.7
24°	10 42.7	10 50.2	10 58.5	11 07.8	11 18.0	11 29.0	11 40.9	11 53.4	12 06.2
20°	10 44.0	10 52.4	11 01.8	11 12.1	11 23.3	11 35.4	11 48.2	12 01.5	12 14.8
16°	10 45.1	10 54.4	11 04.7	11 16.0	11 28.2	11 41.2	11 54.8	12 08.7	12 22.3
12°	10 45.8	10 56.0	11 7.1	11 19.3	11 32.4	11 46.3	12 00.5	12 14.7	12 28.4
8°	10 46	10 56.9	11 09.0	11 22.0	11 35.8	11 50.3	12 04.9	12 19.3	12 32.9

ANNULAR SOLAR ECLIPSE OF DECEMBER 26, 2019



The timings of beginning and ending are expressed in IST

ECLIPSES, 2019

THE ANNULAR ECLIPSE OF THE SUN, DECEMBER 26

PHASES OF ECLIPSE VISIBLE FROM CERTAIN PLACES OF INDIA AND ITS NEIGHBOURHOOD

Places	Partial Eclipse Begins (IST)	Position Angles at Eclipse Begins	Annular phase Begins (IST)	Greatest Eclipse (IST)	Magni-tude	Max-imum. Obscu-ration	Annular phase Ends (IST)	Partial Eclipse Ends (IST)	Position Angles at Eclipse Ends	Dura-tion of Eclipse
	h m	P V	h m	h m			h m	h m	P V	h m
Agartala	8 35.2	255 299	- -	10 00.9	0.499	38.7%	- -	11 38.8	129 125	3 03
Ahmadabad	8 06.4	272 332	- -	9 22.1	0.743	66.7%	- -	10 52.0	119 151	2 45
Aijawl	8 38.5	254 297	- -	10 05.4	0.488	37.6%	- -	11 43.6	129 122	3 05
Ajmer	8 11.4	265 321	- -	9 25.9	0.636	54.1%	- -	10 53.7	125 152	2 42
Allahabad	8 19.1	261 313	- -	9 37.8	0.570	46.6%	- -	11 10.3	128 144	2 51
Amritsar	8 18.8	257 307	- -	9 29.0	0.516	40.4%	- -	10 50.0	132 157	2 31
Bangalore	8 06.5	284 350	- -	9 29.8	0.930	89.6%	- -	11 11.2	108 135	3 04
Bhagalpur	8 27.9	257 304	- -	9 49.4	0.514	40.4%	- -	11 24.1	130 136	2 56
Bhopal	8 11.0	268 325	- -	9 29.2	0.676	58.8%	- -	11 02.2	123 146	2 51
Bhubaneswar	8 20.0	266 319	- -	9 46.1	0.640	54.7%	- -	11 28.4	123 129	3 08
Cannanore*	8 05.0	288 356	9 24.8	9 26.3	0.976	92.9%	9 27.8	11 05.3	105 138	3 00
Chandigarh	8 21.5	255 304	- -	9 32.8	0.494	38.1%	- -	10 55.0	133 155	2 33
Chennai	8 08.9	282 347	- -	9 34.6	0.892	85.1%	- -	11 19.1	110 130	3 10
Cochin	8 06.1	290 360	- -	9 28.5	0.941	91.0%	- -	11 09.0	103 135	3 02
Cooch Behar	8 34.9	253 296	- -	9 56.2	0.464	35.0%	- -	11 29.2	132 133	2 54
Cuttack	8 20.3	265 318	- -	9 46.4	0.634	54.0%	- -	11 28.4	123 129	3 08
Darjeeling	8 33.4	253 297	- -	9 53.2	0.461	34.7%	- -	11 24.6	133 137	2 51
Dehradun	8 20.8	256 306	- -	9 33.1	0.507	39.5%	- -	10 56.8	132 153	2 36
Delhi	8 17.0	260 311	- -	9 30.8	0.555	44.8%	- -	10 56.9	130 152	2 39
Dibrugarh	8 51.0	246 281	- -	10 12.9	0.391	27.5%	- -	11 42.9	135 125	2 51
Dwarka	8 03.6	276 338	- -	9 17.5	0.808	74.6%	- -	10 45.3	116 153	2 41
Gandhinagar	8 06.6	272 332	- -	9 22.2	0.738	66.1%	- -	10 52.1	120 151	2 45
Gangtok	8 34.6	252 295	- -	9 54.2	0.452	33.7%	- -	11 25.1	133 136	2 50
Guwahati	8 39.5	251 293	- -	10 02.1	0.448	33.4%	- -	11 35.6	132 129	2 56
Gaya	8 23.5	259 309	- -	9 44.5	0.548	44.1%	- -	11 19.4	129 138	2 55
Haridwar	8 21.4	256 305	- -	9 33.5	0.500	38.7%	- -	10 57.0	133 154	2 35
Hazaribagh	8 23.2	260 310	- -	9 45.3	0.560	45.5%	- -	11 21.7	128 136	2 58
Hubli	8 05.0	281 346	- -	9 25.4	0.882	83.7%	- -	11 02.9	112 142	2 57
Hyderabad	8 08.2	276 338	- -	9 30.6	0.803	74.1%	- -	11 10.3	115 138	3 02
Imphal	8 43.0	252 292	- -	10 09.1	0.458	34.4%	- -	11 45.4	131 121	3 02
Itanagar	8 46.4	248 286	- -	10 08.4	0.410	29.4%	- -	11 39.6	134 127	2 53
Jaipur	8 13.1	264 318	- -	9 27.8	0.613	51.4%	- -	10 55.7	127 152	2 42
Jalandhar	8 20.8	255 304	- -	9 30.9	0.494	38.1%	- -	10 51.6	133 157	2 30
Jammu	8 20.5	255 304	- -	9 29.7	0.494	38.1%	- -	10 49.1	134 158	2 28
Kanyakumari	8 07.8	292 3	- -	9 31.5	0.910	87.3%	- -	11 13.7	101 131	3 05

‘ - - ‘ indicates annular phase of eclipse not visible corresponding to the places where only partial eclipse occurs

‘*’ Places where annular phase of eclipse occurs

ECLIPSES, 2019

THE ANNULAR ECLIPSE OF THE SUN, DECEMBER 26

PHASES OF ECLIPSE VISIBLE FROM CERTAIN PLACES OF INDIA AND ITS NEIGHBOURHOOD

Places	Partial Eclipse Begins (IST)	Position Angles at Eclipse Begins	Annular phase Begins (IST)	Greatest Eclipse (IST)	Magni-tude	Max-imum. Obscu-ration	Annular phase Ends (IST)	Partial Eclipse Ends (IST)	Position Angles at Eclipse Ends	Dura-tion of Eclipse
	h m	P V	h m	h m			h m	h m	P V	h m
Kavalur	8 08.1	282 348	- -	9 33.1	0.904	86.6%	- -	11 16.7	109 132	3 08
Kavaratti	8 04.0	291 2	- -	9 23.1	0.919	88.3%	- -	10 59.2	103 141	2 55
Kohima	8 45.3	250 288	- -	10 10.0	0.435	32.0%	- -	11 44.3	132 123	2 58
Kolhapur	8 04.4	281 346	- -	9 23.7	0.881	83.6%	- -	10 59.6	112 144	2 55
Kolkata	8 27.0	260 309	- -	9 52.6	0.559	45.4%	- -	11 32.4	127 128	3 05
Koraput	8 14.0	270 328	- -	9 39.0	0.713	63.3%	- -	11 21.0	119 133	3 06
Kozikode*	8 05.4	288 357	9 26.5	9 27.2	0.968	93.0%	9 27.9	11 06.9	105 137	3 01
Kurnool	8 07.3	279 343	- -	9 30.1	0.850	79.9%	- -	11 10.5	113 137	3 03
Lucknow	8 19.8	259 310	- -	9 36.7	0.548	44.1%	- -	11 06.7	130 147	2 46
Madurai*	8 07.5	288 357	9 31.5	9 31.8	0.967	93.1%	9 32.1	11 14.7	104 131	3 07
Mangalore*	8 04.6	286 354	9 24.3	9 25.3	0.969	92.9%	9 26.3	11 03.5	107 140	2 58
Midnapore	8 24.9	261 311	- -	9 49.9	0.573	47.0%	- -	11 29.6	126 130	3 04
Mount Abu	8 07.8	270 328	- -	9 22.6	0.705	62.1%	- -	10 51.2	122 152	2 43
Mumbai	8 04.1	278 342	- -	9 21.7	0.845	79.1%	- -	10 54.9	114 147	2 50
Murshidabad	8 29.7	257 303	- -	9 53.2	0.517	40.7%	- -	11 29.9	129 131	3 00
Muzaffarpur	8 26.2	257 305	- -	9 45.9	0.512	40.2%	- -	11 18.6	131 139	2 52
Mysore	8 05.9	286 353	- -	9 28.4	0.959	93.5%	- -	11 09.0	107 136	3 03
Nagpur	8 11.2	270 328	- -	9 31.9	0.704	62.1%	- -	11 08.6	121 142	2 57
Nalgonda	8 08.8	276 338	- -	9 32.1	0.804	74.2%	- -	11 12.9	115 137	3 04
Nasik	8 05.3	276 338	- -	9 23.1	0.804	74.1%	- -	10 56.5	116 147	2 51
Nellore	8 08.9	280 343	- -	9 33.9	0.858	80.9%	- -	11 17.3	112 132	3 08
Nowgong	8 15.4	263 317	- -	9 33.3	0.607	50.8%	- -	11 05.3	126 146	2 49
Panaji	8 04.3	282 348	- -	9 24.0	0.902	86.2%	- -	11 00.4	111 143	2 56
Patna	8 24.9	258 306	- -	9 45.1	0.527	41.8%	- -	11 18.6	130 139	2 53
Pondicherry	8 08.6	284 350	- -	9 34.3	0.925	89.1%	- -	11 18.9	108 129	3 10
Pune	8 04.7	278 342	- -	9 23.1	0.840	78.5%	- -	10 57.6	114 146	2 52
Port Blair	8 27.8	273 328	- -	10 07.8	0.771	70.4%	- -	12 03.5	111 93	3 35
Puri	8 19.5	266 320	- -	9 46.1	0.651	56.0%	- -	11 29.0	122 128	3 09
Raipur	8 14.4	268 324	- -	9 36.8	0.669	58.0%	- -	11 15.2	122 138	3 00
Rajamundry	8 12.4	274 333	- -	9 38.2	0.763	69.3%	- -	11 21.8	117 131	3 09
Rajkot	8 04.6	275 336	- -	9 19.5	0.787	72.0%	- -	10 48.7	117 152	2 44
Ranchi	8 22.3	261 312	- -	9 45.1	0.576	47.2%	- -	11 22.5	127 135	3 00

‘ - - ‘ indicates annular phase of eclipse not visible corresponding to the places where only partial eclipse occurs

‘*’ Places where annular phase of eclipse occurs

ECLIPSES, 2019

THE ANNULAR ECLIPSE OF THE SUN, DECEMBER 26

PHASES OF ECLIPSE VISIBLE FROM CERTAIN PLACES OF INDIA AND ITS NEIGHBOURHOOD

Places	Partial Eclipse Begins (IST)	Position Angles at Eclipse Begins	Annular phase Begins (IST)	Greatest Eclipse (IST)	Magni-tude	Max-imum. Obscu-ration	Annular phase Ends (IST)	Partial Eclipse Ends (IST)	Position Angles at Eclipse Ends	Dura-tion of Eclipse
	h m	P V	h m	h m			h m	h m	P V	h m
Sambalpur	8 18.1	265 319	- -	9 41.8	0.635	54.0%	- -	11 21.3	124 134	3 03
Shillong	8 39.3	252 293	- -	10 03.0	0.457	34.3%	- -	11 37.5	132 127	2 58
Shimla	8 20.9	256 305	- -	9 32.2	0.500	38.8%	- -	10 54.5	133 155	2 33
Sibsagar	8 49.0	247 284	- -	10 11.7	0.404	28.8%	- -	11 42.8	134 125	2 53
Silchar	8 40.3	252 294	- -	10 05.7	0.466	35.2%	- -	11 41.9	131 124	3 01
Siliguri	8 33.0	253 298	- -	9 53.3	0.468	35.4%	- -	11 25.6	132 136	2 52
Silvassa	8 05.0	276 338	- -	9 22.1	0.803	74.0%	- -	10 54.4	116 148	2 49
Srinagar	8 23.0	253 301	- -	9 30.7	0.464	34.8%	- -	10 48.0	135 159	2 25
Sringeri	8 05.0	284 352	- -	9 26.2	0.939	90.8%	- -	11 04.9	108 139	2 59
Tamelong	8 43.7	251 290	- -	10 09.4	0.450	33.6%	- -	11 45.0	131 122	3 01
Thanjavur	8 08.1	286 354	- -	9 33.3	0.964	93.1%	- -	11 17.4	106 130	3 09
Thiruvanantapuram	8 07.2	291 2	- -	9 30.3	0.912	87.6%	- -	11 11.8	101 132	3 04
Tiruneveil	8 07.7	289 359	- -	9 32.1	0.949	92.1%	- -	11 15.2	103 130	3 07
Trichur*	8 06.0	288 357	9 28.3	9 28.4	0.966	93.0%	9 28.5	11 09.0	105 135	3 03
Udaipur	8 08.6	269 327	- -	9 23.9	0.692	60.7%	- -	10 53.2	122 151	2 44
Ujjain	8 09.3	269 327	- -	9 26.6	0.699	61.5%	- -	10 58.7	122 148	2 49
Vadodara	8 06.4	273 333	- -	9 22.7	0.753	67.9%	- -	10 53.8	119 150	2 47
Varanasi	8 20.9	260 311	- -	9 40.4	0.558	45.2%	- -	11 13.7	128 142	2 52
Vijayawada	8 10.1	276 337	- -	9 34.8	0.798	73.5%	- -	11 17.3	115 134	3 07
Chittagong	8 36.8	255 299	- -	10 04.3	0.505	39.5%	- -	11 43.8	128 121	3 07
Colombo	8 10.4	290 360	- -	9 37.4	0.937	90.7%	- -	11 23.8	102 123	3 13
Dhaka	8 34.3	255 300	- -	9 59.3	0.498	38.7%	- -	11 36.7	129 127	3 02
Karachi	8 04.7	273 333	- -	9 16.3	0.760	68.6%	- -	10 40.4	119 156	2 35
Kathmandu	8 29.3	253 299	- -	9 46.4	0.469	35.5%	- -	11 15.3	133 143	2 46
Lahore	8 18.9	256 307	- -	9 28.7	0.513	40.1%	- -	10 49.1	132 158	2 30
Yangon	8 39.8	261 306	- -	10 18.2	0.602	50.3%	- -	12 07.4	119 97	3 27
Rwalpindi	8 20.7	254 303	- -	9 28.2	0.487	37.2%	- -	10 45.5	134 160	2 24
Islamabad	8 21.2	254 303	- -	9 28.7	0.480	36.5%	- -	10 45.6	134 160	2 24
Thimpu	8 38.6	250 291	- -	9 58.0	0.429	31.3%	- -	11 28.0	134 135	2 49

‘ - - ‘ indicates annular phase of eclipse not visible corresponding to the places where only partial eclipse occurs

‘*’ Places where annular phase of eclipse occurs

ECLIPSES, 2019

THE ANNULAR ECLIPSE OF THE SUN, DECEMBER 26

LOCAL CIRCUMSTANCES RELATING TO PLACES FROM WHERE ANNULAR PHASE IS VISIBLE

Places	Annular phase Begins (IST)	Greatest Eclipse (IST)	Max-imum. Obscu-ration	Annular phase Ends (IST)	Duration of Annularity
	h m	h m		h m	m s
Cannanore*	9 24.8	9 26.3	92.9%	9 27.8	2 59
Kozikode*	9 26.5	9 27.2	93.0%	9 27.9	1 28
Madurai*	9 31.5	9 31.8	93.1%	9 32.1	0 36
Mangalore*	9 24.3	9 25.3	92.9%	9 26.3	2 01
Trichur*	9 28.3	9 28.4	93.0%	9 28.5	0 12

ECLIPSES, 2019

II- Total Eclipse of the Moon, January 21, 2019, Monday

Not Visible in India

Eclipse will be visible in the region covering Middle East, Africa, Europe, the Americas, most of Oceania, easternmost Russia.

The places from where the beginning of the umbral phase is visible at the time of moonset are Namibia, Zambia, Ethiopia, Saudi Arabia, Iran, Kazakhstan and some part of Russia.

The places from where the ending of the umbral phase is visible at the time of moonrise are the South Pacific Ocean, the North Pacific Ocean and easternmost part of Russia.

ELEMENTS OF THE ECLIPSE						
Universal Time of Opposition in Right Ascension : January 21^{d} 05^{h} 07^{m} $42^{s}.93$						
	MOON			SUN		
	h	m	s	h	m	s
Right Ascension	08	12	16.35	08	12	16.35
Hourly Motion			161.10			10.57
	°	'	"	°	'	"
Declination	20	20	34.65	-19	57	51.24
Hourly Motion		-04	51.48			33.13
Equatorial Horizontal Parallax		61	17.87			08.94
True Semi-diameter		16	41.80		16	15.25

CIRCUMSTANCES OF THE ECLIPSE											
	Universal Time			Indian Standard Time			Position Angle measured from the North Point of Moon's Limb (N.E.S.W.)	The Moon being in the Zenith in			
								Latitude		Longitude	
	d	h	m	d	h	m	°	°	'	°	'
Moon enters penumbra	21	02	35.2	21	08	05.2	118	20	28	-36	39
Moon enters umbra	21	03	33.7	21	09	03.7	141	20	23	-50	39
Moon enters Totality	21	04	40.9	21	10	10.9	44	20	13	-66	05
Middle of the eclipse*	21	05	12.4	21	10	42.4	--	20	15	-74	17
Moon leaves Totality	21	05	43.8	21	11	13.8	83	20	08	-81	09
Moon leaves umbra	21	06	51.0	21	12	21.0	267	20	02	-97	15
Moon leaves penumbra	21	07	49.5	21	13	29.5	269	19	56	-111	16

*Magnitude of the eclipse =1.201 (Moon's diam =1.0). Distance between the centers at middle 1355".7

Radius of shadow cone at Moon's distance: Penumbra 4749".6, Umbra 2760".1

EASTERN AND WESTERN LIMITS OF VISIBILITY

Eastern Limit Moonset at beginning (3h 33.7 U.T.)						Western Limit Moonrise at ending (6h 51.0m U.T.)					
Latitude	Longitude		Latitude	Longitude		Latitude	Longitude		Latitude	Longitude	
	°	′	°	°	′	°	°	′	°	°	′
-50	+13	03	+10	+43	06	-50	-161	30	+10	+169	04
40	21	10	20	47	07	40	169	27	20	165	07
30	26	57	30	51	44	30	175	06	30	160	36
20	31	34	40	57	31	20	-179	38	40	154	56
-10	35	35	50	65	38	-10	+176	26	50	147	00
0	+39	21	+60	+79	25	0	+172	45	+60	+133	36

The eclipse is visible in the region west of the eastern limit and east of the western limit. Here, moonset and moonrise times relate to visibility of the center of the Moon on the horizon.

ECLIPSES, 2019

IV- Partial Eclipse of the Moon, July 16-17, 2019, Tuesday-Wednesday

Visible in India

Eclipse will be visible in the region covering Australasia, Asia except north east, Africa, Europe except northern most Scandinavia, most of South America.

The places from where the beginning of the umbral phase is visible at the time of moonset are some part of New Zealand, eastern part of Australia, South Korea, North Korea, northeastern part of China and some part of Russia.

The places from where the ending of the umbral phase is visible at the time of moonrise are Argentina, Chile, Bolivia, western part of Brazil, Peru and North Atlantic Ocean.

Visibility in India : The eclipse is visible from beginning to end from all places of India except extreme from north eastern part of Arunachal Pradesh.

ELEMENTS OF THE ECLIPSE

Universal Time of Opposition in Right Ascension : July 16^{d} 21^{h} 25^{m} $06^{s}.85$

	MOON			SUN		
	h	m	s	h	m	s
Right Ascension	19	43	47.87	7	43	47.85
Hourly Motion			131.92			10.08
	°	'	"	°	'	"
Declination	-21	53	06.66	21	17	41.32
Hourly Motion		2	33.74			-24.90
Equatorial Horizontal Parallax		54	58.32			8.65
True Semi-diameter		14	58.43		15	44.16

CIRCUMSTANCES OF THE ECLIPSE

	Universal Time			Indian Standard Time			Position Angle measured from the North Point of Moon's Limb (N.E.S.W.)	The Moon being in the Zenith in			
								Latitude		Longitude	
	d	h	m	d	h	m	°	°	'	°	'
Moon enters penumbra	16	18	42.2	17	00	12.2	62	-22	00	+79	54
Moon enters umbra	16	20	01.4	17	01	31.5	46	-21	59	+60	12
Middle of the eclipse*	16	21	30.8	17	03	00.8	--	-21	53	+39	10
Moon leaves umbra	16	23	00.1	17	04	30.1	306	-21	49	+17	36
Moon leaves penumbra	17	00	19.4	17	05	49.4	290	-21	45	-01	33

*Magnitude of the eclipse =0.658 (Moon's diam =1.0). Distance between the centers at middle 2120".4

Radius of shadow cone at Moon's distance: Penumbra 4330".5, Umbra 2404".4

EASTERN AND WESTERN LIMITS OF VISIBILITY

Eastern Limit Moonset at beginning (20 h 01.4m U.T.)						Western Limit Moonrise at ending (23h 00.1m U.T.)					
Latitude	Longitude		Latitude	Longitude		Latitude	Longitude		Latitude	Longitude	
°	°	'	°	°	'	°	°	'	°	°	'
-50	+178	57	+10	+146	07	-50	-100	54	+10	-68	21
40	169	60	20	141	45	40	92	02	20	64	02
30	163	40	30	136	43	30	85	46	30	59	03
20	158	39	40	130	24	20	80	47	40	52	47
-10	154	17	50	121	26	-10	76	27	50	43	55
0	+150	12	+60	+105	50	0	-72	24	+60	-28	31

The eclipse is visible in the region west of the eastern limit and east of the western limit. Here, moonset and moonrise times relate to visibility of the center of the Moon on the horizon.

TRANSIT OF MERCURY, 2019

V- Transit of Mercury over the disc of the Sun, November 11, 2019, Monday.

Not Visible in India

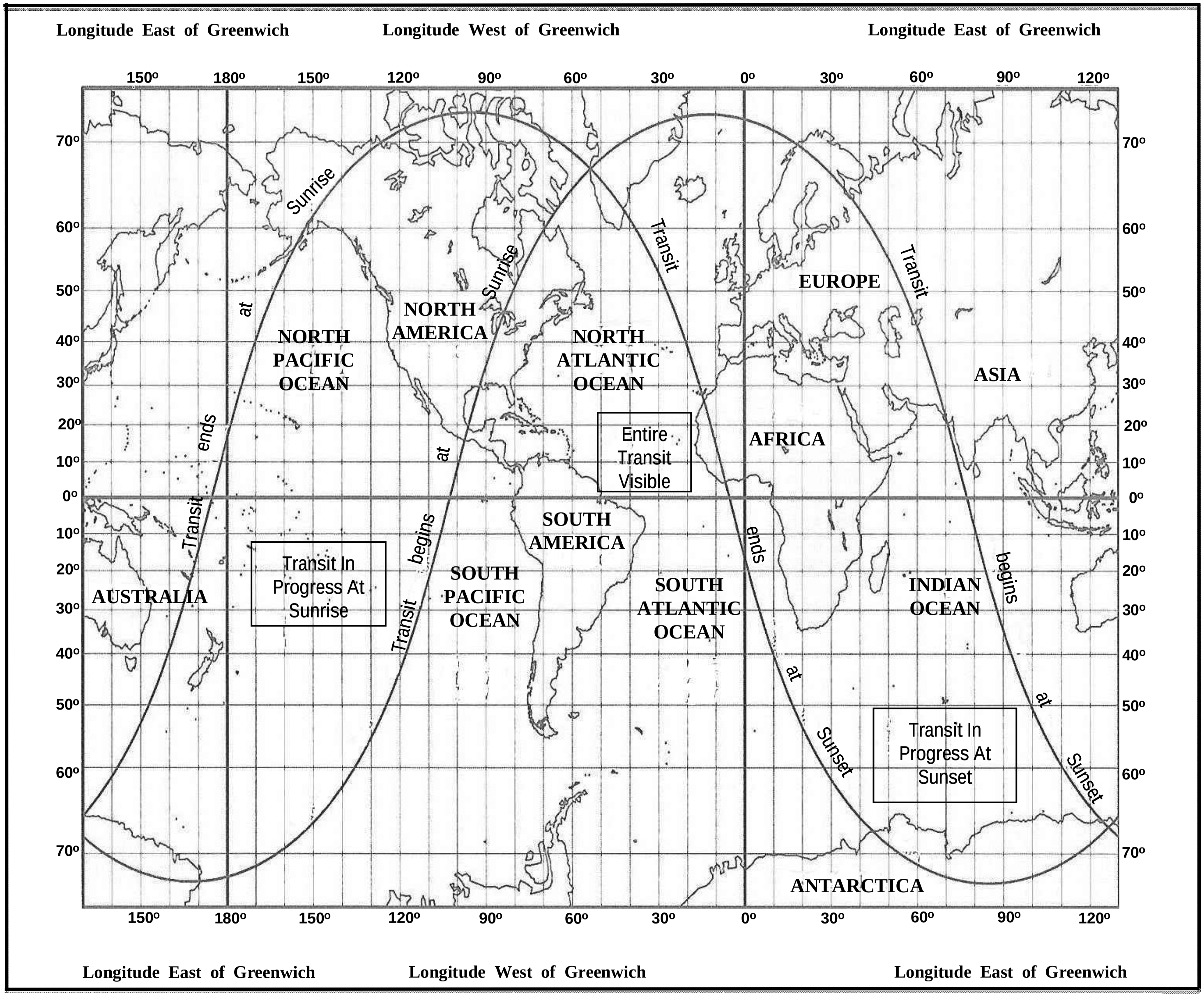
The transit of Mercury is visible from Middle East, most of Europe, Africa, southern Greenland, Antarctica, South America, North America (except Alaska), most of Oceania, New Zealand.

The entire transit will be visible from eastern North America, South America, Antarctica, extreme southern Greenland, extreme western Africa and the Atlantic Ocean.

CIRCUMSTANCES OF THE TRANSIT												
	Universal Time				Indian Standard Time				Position Angle from the North Point of Sunĉs Disc (P)	Mercury being in the Zenith in			
										Latitude		Longitude	
	d	h	m	s	d	h	m	s	°	°	'	°	'
Ingress, exterior contact	11	12	35	27.2	11	18	05	27.2	110	-17	31	-12	36
Ingress, interior contact	11	12	37	08.5	11	18	07	08.5	110	-17	31	-13	02
Least angular distance*	11	15	19	48.3	11	20	49	48.3	24	-17	26	-53	57
Egress, interior contact	11	18	02	33.3	11	23	32	33.3	299	-17	21	-94	53
Egress, exterior contact	11	18	04	14.7	11	23	34	14.7	299	-17	21	-95	19

Least angular distance* = 1ô15ě9

TRANSIT OF MERCURY OF NOVEMBER 11, 2019



The timings of beginning and ending are expressed in UT

OCCULTATIONS, 2019

PLANETS BY THE MOON

Sl. No	Date and Ingress - Egress Times (U.T.)		Planet	Magnitude of Planet	Area of Visibility
		h -- h			
1.	Jan. 31	15.1-20.1	Venus	-4.3	E. Micronesia, Polynesia (except Hawaii), Galapagos Island, S. Central America, N.W.S. America
2.	Feb. 2	05.1-09.0	Saturn	0.6	N. and N.E. Africa, S. and central Europe, Middle East, W. Asia, parts of S. Russia
3.	Feb. 2	18.4-22.3	Pluto	14.3	N. Micronesia, Hawaii, Aleutian Island, W. and central North America (except Alaska)
4.	Mar. 1	16.2-20.7	Saturn	0.6	Most of Micronesia, North Polynesia (except Hawaii), Central America, S. North America
5.	Mar. 2	01.8-06.0	Pluto	14.3	N.E. Africa, S.W. Europe, Middle East, India, most of S. and E. Asia, most of China, most of Mongolia
6.	Mar. 29	02.7-07.3	Saturn	0.6	E. edge of Brazil, southern Africa, Madagascar, S. tip of India, Sri Lanka
7.	Mar. 29	09.4-13.9	Pluto	14.3	W. and S. Mexico, Central America, N. half of S. America, Madeira, Cape Verde Island, W. edge of Africa
8.	Apr. 25	12.3-16.7	Saturn	0.5	E. Australia, New Zealand, W. South America
9.	Apr. 25	17.5-22.1	Pluto	14.3	Sri Lanka, Indonesia, Australia, Melanesia, S.E. Micronesia, N.W. Polynesia
10.	May 22	20.3-24.3	Saturn	0.3	S. tip of Africa, parts of E. Antarctica, Kerguelen Island, most of Australia, S. New Zealand
11.	May 23	01.7-06.2	Pluto	14.2	Central South America, S. and E. Africa
12.	June 19	01.7-05.9	Saturn	0.2	Easter Island, S. South America, Antarctic Peninsula, southern Africa
13.	June 19	09.0-13.5	Pluto	14.2	Melanesia, N.E. Australia, S. Micronesia, S. Polynesia, Central America, W. south America
14.	July 04	03.5-07.9	Mars	1.8	E. tip of Africa, Arabian Peninsula, most of Asia, Micronesia
15.	July 16	05.1-09.5	Saturn	0.1	E. Melanesia, S. Polynesia, Easter Island, central south America
16.	July 16	15.0-19.6	Pluto	14.2	E. Africa, Madagascar, S. Indonesia, N. and W. Australia, W. Micronesia

OCCULTATIONS, 2019

PLANETS BY THE MOON

Sl. No	Date and Ingress - Egress Times (U.T.)		Planet	Magnitude of Planet	Area of Visibility
		h -- h			
17.	Aug. 12	07.6-12.2	Saturn	0.2	E. Indonesia, most of Australia, N. New Zealand, Melanesia, Polynesia (except Hawaii)
18.	Aug. 12	20.0-24.5	Pluto	14.2	N.E. South America, Ascension Island, central and E. Africa, S. Arabian Peninsula
19.	Sept. 8	11.4-16.0	Saturn	0.4	E. Africa, Madagascar, S. Indonesia, W and N. Australia, W. Micronesia, W. Melanesia
20.	Sept. 9	00.8-05.4	Pluto	14.3	Polynesia (except Hawaii), Easter Island, Galapagos Island, N. South America
21.	Oct. 5	18.4-22.8	Saturn	0.5	Easter Island, S South America, South Georgia, Southern Africa
22.	Oct. 6	07.0-11.5	Pluto	14.3	Australia, Melanesia, S.E. Micronesia, W. Polynesia
23.	Nov. 2	05.4-09.4	Saturn	0.6	Kerguelen Island, Prince Edward Island, E. Antarctica, S. Tasmania, New Zealand, S. Polynesia
24.	Nov. 2	15.4-19.8	Pluto	14.3	S. South America, South Georgia, southern Africa, Madagascar
25.	Nov. 28	09.2-12.7	Jupiter	-1.8	N. Africa, most of Europe, Middle East, W. Asia
26.	Nov. 29	19.7-22.6	Saturn	0.6	S. New Zealand, Antarctica, South Georgia
27.	Nov. 30	01.9-05.9	Pluto	14.4	S. Australasia, Kerguelen Island, parts of Antarctica, S.E. Polynesia
28.	Dec. 27	12.7-16.5	Pluto	14.4	S. South America, South Georgia, parts of Antarctica, Kerguelen Island, S. tip of Africa, S. Madagascar
29.	Dec. 29	00.6-03.3	Venus	-4.0	Antarctica, S. tip of South America

OCCULTATIONS, 2019

ELEMENTS OF OCCULTATIONS OF PLANETS

Sl. No.	T_0 (U.T. of Conj. in R.A.)			H_0		Y	x′	y′	Body Occulted					
									Right Ascension			Declination		
	d	h	m	h	m				h	m	s	°	′	″
1.	Jan. 31	17	34.6	10	34.2	0.0990	0.5019	-0.0551	17	44	26.16	-20	47	36.54
2.	Feb. 2	7	05.4	-01	09.7	0.6863	0.5462	0.0116	19	05	19.70	-22	07	59.74
3.	Feb. 2	20	25.8	11	44.4	0.6920	0.5477	0.0369	19	33	50.81	-21	50	26.43
4.	Mar. 1	18	28.0	11	49.6	0.3442	0.5445	0.0226	19	16	55.81	-21	49	31.25
5.	Mar. 2	3	58.9	-02	58.2	0.5739	0.5455	0.0407	19	37	11.35	-21	45	27.77
6.	Mar. 29	4	59.0	00	00.7	-0.0584	0.5467	0.0307	19	25	01.21	-21	34	54.86
7.	Mar. 29	11	41.6	06	30.1	0.3402	0.5464	0.0436	19	39	24.52	-21	42	59.24
8.	Apr. 25	14	26.7	11	13.0	-0.4069	0.5527	0.0341	19	28	26.40	-21	28	52.44
9.	Apr. 25	19	49.4	16	24.9	0.0805	0.5509	0.0447	19	40	09.52	-21	44	00.44
10.	May 22	22	13.6	20	49.3	-0.5638	0.5598	0.0322	19	26	45.11	-21	33	41.23
11.	May 23	3	56.3	02	20.3	-0.0767	0.5563	0.0437	19	39	23.25	-21	48	40.73
12.	June 19	3	46.4	04	15.5	-0.4783	0.5643	0.0261	19	20	41.96	-21	47	31.32
13.	June 19	11	15.5	11	29.2	-0.0718	0.5596	0.0412	19	37	22.44	-21	56	12.11
14.	July 4	5	39.2	18	12.6	0.0879	0.5793	-0.0762	8	15	49.28	20	59	08.67
15.	July 16	7	14.8	09	39.3	-0.2415	0.5642	0.0182	19	12	24.11	-22	04	57.27
16.	July 16	17	17.0	19	20.9	0.0415	0.5592	0.0385	19	34	41.12	-22	05	02.62
17.	Aug. 12	9	52.7	14	11.6	-0.0423	0.5605	0.0117	19	4	49.44	-22	20	02.62
18.	Aug. 12	22	13.7	26	7.38	0.1327	0.5562	0.0366	19	32	02.97	-22	13	25.44
19.	Sept. 8	13	41.6	-04	8.26	-0.0438	0.5576	0.0086	19	0	39.52	-22	29	06.79
20.	Sept. 9	3	4.87	-15	12.3	0.0840	0.5539	0.0359	19	30	10.86	-22	19	48.32
21.	Oct. 5	20	36.3	04	33.3	-0.2750	0.5587	0.0096	19	1	25.66	-22	30	44.23
22.	Oct. 6	9	12.8	-07	16.4	-0.1218	0.5553	0.0361	19	29	37.04	-22	23	10.82
23.	Nov. 2	7	20.8	-06	59.9	-0.6328	0.5630	0.0145	19	7	17.97	-22	24	14.58
24.	Nov. 2	17	32.5	02	50.1	-0.3872	0.5606	0.0370	19	30	36.32	-22	23	09.13
25.	Nov. 28	10	49.2	00	37.0	0.7587	0.5715	-0.0558	17	55	50.50	-23	17	22.54
26.	Nov. 29	21	02.9	08	20.8	-0.9859	0.5665	0.0231	19	17	23.83	-22	09	06.12
27.	Nov. 30	3	47.1	-09	9.52	-0.5831	0.5664	0.0388	19	33	03.12	-22	19	55.79
28.	Dec. 27	14	30.7	03	18.8	-0.6633	0.5682	0.0417	19	36	32.75	-22	14	19.09
29.	Dec. 29	1	31.2	-10	53.6	-1.0847	0.4981	0.0968	20	55	10.97	-19	18	23.54

OCCULTATIONS, 2019

ELEMENTS (contd.)

Sl. No.	*l*	*a*
1.	0.2733	1.00
2.	0.2726	1.00
3.	0.2725	1.00
4.	0.2726	1.00
5.	0.2725	1.00
6.	0.2726	1.00
7.	0.2725	1.00
8.	0.2726	1.00
9.	0.2725	1.00
10.	0.2726	1.00
11.	0.2725	1.00
12.	0.2726	1.00
13.	0.2725	1.00
14.	0.2728	1.00
15.	0.2726	1.00
16.	0.2725	1.00
17.	0.2726	1.00
18.	0.2725	1.00
19.	0.2726	1.00
20.	0.2725	1.00
21.	0.2726	1.00
22.	0.2725	1.00
23.	0.2726	1.00
24.	0.2725	1.00
25.	0.2726	1.00
26.	0.2726	1.00
27.	0.2725	1.00
28.	0.2725	1.00
29.	0.2731	1.00

PART - V

ASTRONOMICAL PHENOMENA
AND
MISCELLANEOUS TABLES

PHENOMENA, 2019

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h U.T.

Date		Mercury Elong.		Mercury Mag.	Venus Elong.		Venus Mag.	Date		Mercury Elong.		Mercury Mag.	Venus Elong.		Venus Mag.
			°			°					°			°	
Jan.	-3	W.	18	-0.4	W.	47	-4.7	July	1	E.	24	+1.0	W.	12	-3.9
	2		16	-0.4		47	-4.6		6		21	+1.6		11	-3.9
	7		14	-0.5		47	-4.6		11		16	+2.6		9	-3.9
	12		11	-0.6		47	-4.5		16		10	+4.0		8	-3.9
	17		8	-0.7		47	-4.5		21	E.	5	+5.4		7	-3.9
	22	W.	6	-1.0	W.	46	-4.4		26	W.	9	+4.2	W.	5	-3.9
	27	W.	3	-1.3		46	-4.4		31		14	+2.4		4	-3.9
Feb.	1	E.	2	-1.5		45	-4.3	Aug.	5		18	+1.0		3	-4.0
	6		5	-1.4		45	-4.3		10		19	0.0	W.	2	-4.0
	11		9	-1.2		44	-4.2		15		18	-0.7	E.	1	----
	16	E.	13	-1.1	W.	43	-4.2		20	W.	15	-1.1	E.	2	-4.0
	21		16	-1.0		42	-4.2		25		10	-1.3		3	-4.0
	26		18	-0.6		41	-4.1		30		5	-1.7		5	-3.9
Mar.	3		17	+0.2		41	-4.1	Sept.	4	W.	2	-1.9		6	-3.9
	8		13	+2.0		40	-4.1		9	E.	5	-1.4		7	-3.9
	13	E.	5	+4.7	W.	39	-4.0		14	E.	9	-0.9	E.	8	-3.9
	18	W.	6	+4.6		38	-4.0		19		12	-0.6		10	-3.9
	23		15	+2.6		37	-4.0		24		15	-0.4		11	-3.9
	28		21	+1.4		36	-3.9		29		18	-0.3		12	-3.9
Apr.	2		25	+0.8		35	-3.9	Oct.	4		20	-0.2		14	-3.9
	7	W.	27	+0.4	W.	33	-3.9		9	E.	22	-0.1	E.	15	-3.9
	12		28	+0.3		32	-3.9		14		24	-0.1		16	-3.9
	17		27	+0.1		31	-3.9		19		25	-0.1		17	-3.8
	22		26	0.0		30	-3.9		24		24	-0.1		19	-3.8
	27		23	-0.2		29	-3.8		29		22	+0.1		20	-3.8
May	2	W.	20	-0.4	W.	28	-3.8	Nov.	3	E.	17	+0.9	E.	21	-3.8
	7		16	-0.7		26	-3.8		8	E.	8	+3.3		22	-3.8
	12		11	-1.1		25	-3.8		13	W.	3	----		24	-3.9
	17	W.	5	-1.7		24	-3.8		18		13	+1.4		25	-3.9
	22	E.	1	----		23	-3.8		23		19	-0.1		26	-3.9
	27	E.	7	-1.7	W.	21	-3.8		28	W.	20	-0.5	E.	27	-3.9
June	1		12	-1.1		20	-3.8	Dec.	3		19	-0.6		28	-3.9
	6		17	-0.7		19	-3.8		8		18	-0.6		29	-3.9
	11		21	-0.4		17	-3.8		13		15	-0.5		30	-3.9
	16		24	-0.1		16	-3.8		18		13	-0.6		31	-3.9
	21	E.	25	+0.2	W.	15	-3.8		23	W.	10	-0.6	E.	33	-3.9
	26		25	+0.6		13	-3.8		28		8	-0.8		34	-3.9
July	1	E.	24	+1.0	W.	12	-3.9		33	W.	5	-1.0	E.	35	-4.0

Conjunction-	Mercury	Venus	Mercury	Venus
	d h / d h	d h	d h	d h
Superior:	Jan. 30 03 / May 21 13	Aug. 14 06	Sept. 4 02	é
Inferior:	Mar. 15 02 / July 21 13	é	Nov. 11 15	é

N.B.- E. means that the planet is in the east of the Sun and W. means that it is in the west of the Sun by the amount of the arc stated.

PHENOMENA, 2019

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h UT

Date		Mars		Jupiter		Saturn		Uranus	Neptune	Pluto
		Elong.	Mag.	Elong.	Mag.	Elong.	Mag.	Elong.	Elong.	Elong.
		°		°		°		°	°	°
Jan.	-3	E. 81	+0.4	W. 25	-1.8	E. 5	+0.5	E. 112	E. 68	E. 14
	7	78	+0.5	33	-1.8	W. 4	+0.5	102	58	E. 4
	17	74	+0.7	42	-1.8	13	+0.5	92	48	W. 5
	27	71	+0.8	50	-1.9	22	+0.6	82	38	15
Feb.	6	67	+0.9	58	-1.9	31	+0.6	72	28	25
	16	E. 64	+1.0	W. 67	-2.0	W. 40	+0.6	E. 62	E. 18	W. 35
	26	61	+1.1	76	-2.0	50	+0.6	53	E. 9	45
Mar.	8	57	+1.2	84	-2.1	59	+0.6	43	W. 1	55
	18	54	+1.3	94	-2.1	68	+0.6	33	11	64
	28	51	+1.4	103	-2.2	77	+0.6	24	20	74
Apr.	7	E. 48	+1.5	W. 113	-2.3	W. 87	+0.6	E. 15	W. 30	W. 84
	17	44	+1.6	122	-2.4	96	+0.5	E. 6	39	94
	27	41	+1.6	133	-2.4	106	+0.5	W. 4	49	103
May	7	38	+1.7	143	-2.5	116	+0.4	13	58	113
	17	35	+1.7	153	-2.5	126	+0.4	22	67	123
	27	E. 32	+1.7	W. 164	-2.6	W. 135	+0.3	W. 31	W. 77	W. 133
June	6	28	+1.8	W. 175	-2.6	146	+0.3	40	86	142
	16	25	+1.8	E. 174	-2.6	156	+0.2	49	96	152
	26	22	+1.8	163	-2.6	166	+0.1	58	105	162
July	6	19	+1.8	153	-2.6	W. 176	+0.1	68	115	W. 172
	16	E. 16	+1.8	E. 142	-2.5	E. 174	+0.1	W. 77	W. 125	E. 179
	26	13	+1.8	132	-2.5	163	+0.1	86	134	169
Aug.	5	9	+1.8	122	-2.4	153	+0.2	96	144	159
	15	6	+1.8	113	-2.3	143	+0.2	105	154	149
	25	E. 3	+1.8	103	-2.3	133	+0.3	115	164	139
Sept.	4	W. 1	+1.7	E. 94	-2.2	E. 123	+0.3	W. 125	W. 174	E. 130
	14	4	+1.8	85	-2.1	113	+0.4	135	E. 176	120
	24	7	+1.8	77	-2.1	103	+0.4	145	166	110
Oct.	4	11	+1.8	68	-2.0	94	+0.5	155	156	100
	14	14	+1.8	60	-2.0	84	+0.5	165	146	90
	24	W. 17	+1.8	E. 52	-1.9	E. 75	+0.5	W. 175	E. 136	E. 80
Nov.	3	21	+1.8	43	-1.9	65	+0.6	E. 174	126	71
	13	24	+1.8	35	-1.9	56	+0.6	164	116	61
	23	28	+1.7	27	-1.9	47	+0.6	153	106	51
Dec.	3	31	+1.7	20	-1.8	38	+0.6	143	95	41
	13	W. 35	+1.7	E. 12	-1.8	E. 29	+0.6	E. 132	E. 85	E. 31
	23	38	+1.6	E. 4	-1.8	20	+0.5	122	75	21
	33	42	+1.6	W. 4	-1.8	10	+0.5	112	65	11
	43	W. 45	+1.5	W. 12	-1.8	E. 1	+0.5	E. 101	E. 55	E. 2
		d h		d h		d h		d h	d h	d h
Conjunction:		Sept. 2 11		Dec. 27 18		Jan. 2 06		Apr. 22 23	Mar. 7 01	Jan. 11 12
Opposition:		é		June 10 15		July 9 17		Oct. 28 08	Sept.10 07	July 14 15

Magnitudes at opposition: Uranus +5.7; Neptune +7.8; Pluto +14.2

N.B. - E. means that the planet is in the east of the Sun and W. means that it is in the west of the Sun by the amount of the arc stated.

PHENOMENA, 2019

CONJUNCTIONS, OPPOSITIONS ETC. OF PLANETS WITH THE SUN (IN LONGTITUDE)

UNIVERSAL TIME

MERCURY

		d	h	m		d	h	m
Superior conjuction		é	é	é	May	21	13	06
Heliacal rising E.		é	é	é	May	29	22	58
Greatest elongation E.		é	é	é	June	23	23	16 (25ę.2)
Retrograde		é	é	é	July	7	23	14
Heliacal setting E.		é	é	é	July	11	07	07
Inferior conjunction		é	é	é	July	21	12	35
Heliacal rising W.		é	é	é	July	29	04	59
Direct		é	é	é	Aug.	1	03	50
Greatest elongation W.		é	é	é	Aug.	9	23	08 (19ę.0)
Heliacal setting W.	Jan.	10	05	57	Aug.	25	03	51
Superior conjuction	Jan.	30	02	50	Sept.	4	01	41
Heliacal rising E.	Feb.	12	07	06	Sept.	22	12	45
Greatest elongation E.	Feb.	27	01	25 (18ę.1)	Oct.	20	04	02 (24ę.6)
Retrograde	Mar.	5	18	23	Oct.	31	15	31
Heliacal setting E.	Mar.	9	11	24	Nov.	4	15	38
Inferior conjunction	Mar.	15	01	47	Nov.	11	15	22
Heliacal rising W.	Mar.	21	12	55	Nov.	16	04	54
Direct	Mar.	28	14	03	Nov.	20	19	24
Greatest elongation W.	Apr.	11	19	42 (27ę.7)	Nov.	28	10	29 (20ę.1)
Heliacal setting W.	May	6	21	17	Dec.	22	07	00

VENUS

		d	h	m		d	h	m
Superior conjuction		é	é	é	Aug.	14	06	07
Heliacal rising E.		é	é	é	Sept.	9	23	09
Greatest elongation E.		é	é	é		é	é	é
Retrograde		é	é	é		é	é	é
Heliacal setting E.		é	é	é		é	é	é
Inferior conjunction		é	é	é		é	é	é
Heliacal rising W.		é	é	é		é	é	é
Direct		é	é	é		é	é	é
Greatest elongation W.	Jan.	6	04	54 (47ę.0)		é	é	é
Heliacal setting W.	July	23	09	23		é	é	é

EARTH

		d	h	m			d	h	m		d	h	m
Perihelion	Jan.	3	05	23	Equinoxes	Mar.	20	21	58	Sept.	23	07	50
Aphelion	July	4	22	13	Solstices	June	21	15	54	Dec.	22	04	19

SUPERIOR PLANETS

	MARS				JUPITER				SATURN			
		d	h	m		d	h	m		d	h	m
Conjunction	Sept.	2	10	42	Dec.	27	18	25	Jan.	2	05	50
Heliacal rising W.	Oct.	13	22	49		é	é	é	Jan.	17	11	31
Retrograde		é	é	é	Apr.	10	17	01	Apr.	30	00	56
Opposition		é	é	é	June	10	15	28	July	9	17	07
Direct		é	é	é	Aug.	11	13	37	Sept.	18	08	46
Heliacal setting E.	July	11	06	31	Dec.	16	00	27	Dec.	30	18	46

PHENOMENA, 2019

CONJUNCTIONS, OPPOSITIONS ETC. OF PLANETS WITH THE SUN (IN LONGITUDE)

UNIVERSAL TIME

SUPERIOR PLANETS

	URANUS		NEPTUNE		PLUTO	
		d h m		d h m		d h m
Conjuction	Apr.	22 23 06	Mar.	7 01 00	Jan.	11 11 35
Retrograde	Aug.	12 02 24	June	21 14 39	Apr.	24 18 47
Opposition	Oct.	28 08 15	Sept.	10 07 24	July	14 14 47
Direct	Jan.	6 20 26	Nov.	27 12 33	Oct.	3 06 39

N.B.- The heliacal risings and settings have been calcuted for 23° 11' north latitude. Here E. means east of the Sun or the western horizon and W. means west of the Sun or the eastern horizon.

PHENOMENA, 2019

CONJUNCTION OF PLANETS WITH THE MOON AND OTHER PLANETS (IN LONGITUDE)

UNIVERSAL TIME

	d h m			d h m	
Jan.	1 22 26	Moon conj. Venus	Apr.	25 14 34	Moon conj. Saturn
	3 08 23	Moon conj. Jupiter	May	2 14 39	Moon conj. Venus
	4 17 42	Moon conj. Mercury		3 08 47	Moon conj. Mercury
	5 18 32	Moon conj. Saturn		7 23 50	Moon conj. Mars
	13 00 12	Moon conj. Mars		20 17 05	Moon conj. Jupiter
	13 13 31	*Mercury conj. Saturn*		22 22 23	Moon conj. Saturn
	22 12 26	*Venus conj. Jupiter*	June	1 19 55	Moon conj. Venus
	31 00 23	Moon conj. Jupiter		4 15 42	Moon conj. Mercury
	31 17 35	Moon conj. Venus		5 14 48	Moon conj. Mars
Feb.	2 06 57	Moon conj. Saturn		16 19 09	Moon conj. Jupiter
	5 07 11	Moon conj. Mercury		18 16 05	*Mercury conj. Mars*
	10 20 48	Moon conj. Mars		19 03 54	Moon conj. Saturn
	18 10 52	*Venus conj. Saturn*	July	1 21 48	Moon conj. Venus
	27 14 34	Moon conj. Jupiter		4 05 41	Moon conj. Mars
Mar.	1 18 23	Moon conj. Saturn		4 09 49	Moon conj. Mercury
	2 22 03	Moon conj. Venus		8 22 27	*Mercury conj. Mars*
	7 19 08	Moon conj. Mercury		13 20 11	Moon conj. Jupiter
	11 15 27	Moon conj. Mars		16 07 18	Moon conj. Saturn
	27 02 37	Moon conj. Jupiter		25 00 26	*Mercury conj. Venus*
	29 05 00	Moon conj. Saturn		31 03 32	Moon conj. Mercury
Apr.	2 06 32	Moon conj. Venus		31 20 51	Moon conj. Venus
	3 01 58	Moon conj. Mercury	Aug.	1 20 48	Moon conj. Mars
	9 08 16	Moon conj. Mars		9 23 25	Moon conj. Jupiter
	23 11 44	Moon conj. Jupiter		12 09 54	Moon conj. Saturn
	25 14 34	Moon conj. Saturn		24 17 05	*Venus conj. Mars*

PHENOMENA, 2019 --- *contd.*

CONJUNCTION OF PLANETS WITH THE MOON AND OTHER PLANETS (IN LONGITUDE)

UNIVERSAL TIME

	d h m			d h m	
Aug.	30 02 22	Moon conj. Mercury	Oct.	30 22 06	*Mercury conj. Venus*
	30 12 14	Moon conj. Mars		31 14 30	Moon conj. Jupiter
	30 18 12	Moon conj. Venus	Nov.	2 07 29	Moon conj. Saturn
	3 15 40	*Mercury conj. Mars*		24 11 36	Moon conj. Mars
Sept.	6 07 20	Moon conj. Jupiter		24 13 34	*Venus conj. Jupiter*
	8 13 43	Moon conj. Saturn		25 03 49	Moon conj. Mercury
	13 15 11	*Mercury conj. Venus*		28 10 50	Moon conj. Jupiter
	28 03 57	Moon conj. Mars		28 18 43	Moon conj. Venus
	29 15 37	Moon conj. Venus		29 21 17	Moon conj. Saturn
	30 02 05	Moon conj. Mercury	Dec.	11 10 05	*Venus conj. Saturn*
Oct.	3 20 40	Moon conj. Jupiter		23 03 27	Moon conj. Mars
	5 20 40	Moon conj. Saturn		25 11 18	Moon conj. Mercury
	26 19 48	Moon conj. Mars		26 07 29	Moon conj. Jupiter
	29 15 14	Moon conj. Venus		27 12 08	Moon conj. Saturn
	29 17 34	Moon conj. Mercury		29 02 07	Moon conj. Venus

CONJUNCTIONS OF PLANETS WITH BRIGHT STARS (IN R.A.)

	d h m			d h m	
Jan.	15 20 37	Venus 7°.93 N. of *Antares*	Aug.	17 23 26	Mars 0°.70 N. of *Regulus*
Apr.	16 21 46	Mars 6°.54 N. of *Aldebaran*	Aug.	21 04 19	Venus 0°.96 N. of *Regulus*
May	26 11 32	Mercury 6°.66 N. of *Aldebaran*	Aug.	29 03 07	Mercury 1°.36 N. of *Regulus*
Jun.	17 20 52	Venus 4°.80 N. of *Aldebaran*	Sept.	28 22 38	Mercury 1°.42 N. of *Spica*
Jun.	21 05 05	Mercury 5°.74 S. of *Pollux*	Oct.	3 00 57	Venus 3°.13 N. of *Spica*
Jun.	23 07 10	Mars 5°.60 S. of *Pollux*	Nov.	8 14 38	Mars 3°.06 N. of *Spica*
Jul.	23 15 55	Venus 6°.09 S. of *Pollux*	Nov.	9 10 36	Venus 3°.96 N. of *Antares*
Jul.	26 06 25	Mercury 11°.61 S. of *Pollux*	Dec.	15 16 11	Mercury 5°.14 N. of *Antares*
Aug.	5 22 14	Mercury 9°.33 S. of *Pollux*			

ASTRONOMICAL DIARY, 2019

UNIVERSAL TIME

	d	h	m			d	h	m	
Jan.	1	21	49	Venus 1ę.3 S of Moon	Feb.	18	13	53	Venus 1ę.1 N of Saturn
	1	23	46	Mercury in descending node		19	09	03	Moon at perigee
	2	05	50	Saturn in conjunction with Sun		19	11	05	Mercury 0ę.8 N of Neptune
	3	05	23	Earth at perihelion		19	15	54	FULL MOON
	3	07	35	Jupiter 3ę.1 S of Moon		20	15	60	Mercury in ascending node
	4	17	40	Mercury 2ę.8 S of Moon		22	16	44	Moon greatest lat. N 5ę07'
	5	18	42	Saturn 0ę.9 S of Moon		25	08	01	Mercury at perihelion
	6	01	28	NEW MOON; *Solar Eclipse*		26	11	28	LAST QUARTER
	6	04	54	Venus greatest elongation W. (47ę.0)		27	01	25	Mercury greatest elong. E. (18ę.1)
	7	00	08	Moon in descending node		27	14	16	Jupiter 2ę.3 S of Moon
	7	02	24	Uranus stationary in RA	Mar.	1	18	28	Saturn 0ę.3 S of Moon
	9	04	29	Moon at apogee					*Occultation*
	10	22	21	Neptune 3ę.1 N of Moon		2	11	03	Moon in descending node
	11	11	35	Pluto in conjunction with Sun		2	21	27	Venus 1ę.2 N of Moon
	12	08	24	Mercury at aphelion		4	11	26	Moon at apogee
	12	19	47	Mars 5ę.3 N of Moon		5	05	30	Mercury stationary in RA
	13	10	47	Mercury 1ę.7 S. of Saturn		6	14	19	Neptune 3ę.2 N of Moon
	14	06	09	Moon greatest lat. S 5ę14'		6	16	04	NEW MOON
	14	06	46	FIRST QUARTER		7	01	00	Neptune in conjunction with Sun
	14	12	29	Uranus 5ę.1 N of Moon		7	12	35	Mercury 8ę.4 N of Moon
	15	04	49	Mars in ascending node		7	13	13	Mercury greatest helio. lat N.
	15	20	37	Venus 7ę.9 N. of *Antares*		9	10	51	Moon greatest lat. S 5ę0 4'
	17	08	04	Venus greatest helio. lat N.		10	04	11	Uranus 4ę.9 N of Moon
	19	01	30	Uranus in square with Sun		11	12	09	Mars 5ę.8 N of Moon
	20	22	49	Moon in ascending node		14	01	29	Jupiter in square with Sun
	21	05	16	FULL MOON; *Lunar Eclipse*		14	09	39	Venus in descending node
	21	20	00	Moon at perigee		14	10	27	FIRST QUARTER
	22	05	48	Venus 2ę.4 N. of Jupiter		15	01	47	Mercury in inferior conjunction
	26	13	02	Moon greatest lat. N 5ę16'					3ę30' N of Sun
	27	21	10	LAST QUARTER		16	16	23	Moon in ascending node
	30	02	50	Mercury in superior conjunction		19	19	48	Moon at perigee
				2ę50' S of Sun		20	21	58	*Vernal Equinox*
	30	23	53	Jupiter 2ę.8 S of Moon		21	01	43	FULL MOON
	31	17	35	Venus 0ę.1 S of Moon		22	06	29	Mercury 3ę.4 N of Neptune
				Occultation		22	08	28	Moon greatest lat. N 4ę59'
Feb.	1	14	30	Mercury greatest helio lat. S.		27	02	27	Jupiter 1ę.9 S of Moon
	2	07	05	Saturn 0ę.62 S of Moon		27	11	45	Mercury stationary in RA
				Occultation		28	04	10	LAST QUARTER
	3	06	35	Moon in descending node		29	04	59	Saturn 0ę.1 N of Moon
	4	21	04	NEW MOON					*Occultation*
	5	07	02	Mercury 0ę.2 N of Moon		29	13	09	Moon in descending node
	5	09	29	Moon at apogee		30	22	55	Mercury in descending node
	7	06	15	Neptune 3ę.1 N of Moon	Apr.	1	00	14	Moon at apogee
	10	09	13	Moon greatest lat. S 5ę12'		2	04	17	Venus 2ę.7 N of Moon
	10	16	19	Mars 6ę.1 N of Moon		2	18	41	Mercury 0ę.4 N of Neptune
	10	20	20	Uranus 5ę.1 N of Moon		2	22	51	Neptune 3ę.3 N of Moon
	12	22	26	FIRST QUARTER		2	23	02	Mercury 3ę.6 N of Moon
	13	20	10	Mars 1ę.1 N of Uranus		5	08	50	NEW MOON
	17	09	42	Moon in ascending node		5	11	33	Moon greatest lat. S 5ę00'

ASTRONOMICAL DIARY, 2019

UNIVERSAL TIME

	d	h	m			d	h	m	
Apr.	6	12	59	Uranus 4°.8 N of Moon	May	26	13	27	Moon at apogee
	9	06	40	Mars 4°.7 N of Moon		26	16	34	LAST QUARTER
	10	03	47	Venus 0°.3 S of Neptune		27	16	43	Neptune 3°.7 N of Moon
	10	07	40	Mercury at aphelion		29	15	08	Moon greatest lat. S 5° 07'
	10	08	47	Saturn in square with Sun		31	10	24	Uranus 4°.8 N of Moon
	10	17	03	Jupiter stationary in RA	June	1	18	14	Venus 3°.2 N of Moon
	11	19	42	Mercury greatest elong. W. (27°.7)		3	10	02	NEW MOON
	12	18	09	Moon in ascending node		3	12	28	Mercury greatest helio. lat N.
	12	19	06	FIRST QUARTER		4	15	40	Mercury 3°.7 N of Moon
	13	08	04	Pluto in square with Sun		5	15	05	Mars 1°.6 N of Moon
	16	21	46	Mars 6°.5 N of *Aldebaran*		5	22	47	Moon in ascending node
	16	22	05	Moon at perigee		7	23	15	Moon at perigee
	18	02	30	Venus at aphelion		9	19	34	Neptune in square with Sun
	18	11	21	Moon greatest lat. N 5° 00'		10	05	59	FIRST QUARTER
	19	11	12	FULL MOON		10	15	28	Jupiter in opposition with Sun
	22	23	06	Uranus in conjunction with Sun		11	15	35	Moon greatest lat. N 5° 10'
	23	11	35	Jupiter 1°.6 S of Moon		16	18	50	Jupiter 2°.0 S of Moon
	25	08	46	Pluto stationary in RA		17	08	31	FULL MOON
	25	14	27	Saturn 0°.4 N of Moon		17	20	52	Venus 4°.8 N of *Aldebaran*
				Occultation		18	14	35	Mercury 0°.2 N of Mars
	25	15	02	Moon in descending node		19	01	50	Moon in descending node
	26	22	18	LAST QUARTER		19	03	46	Saturn 0°.4 N of Moon
	28	18	20	Moon at apogee					*Occultation*
	30	02	30	Saturn stationary in RA		21	05	05	Mercury 5°.7 S of *Pollux*
	30	07	48	Neptune 3°.5 N of Moon		21	15	54	*Summer Solstice*
	30	13	46	Mercury greatest helio lat. S.		22	03	59	Neptune stationary in RA
May	2	11	39	Venus 3°.6 N of Moon		23	07	10	Mars 5°.6 S of *Pollux*
	2	12	39	Moon greatest lat. S 5° 02'		23	07	50	Moon at apogee
	3	06	25	Mercury 2°.9 N of Moon		23	23	16	Mercury greatest elong. E. (25°.2)
	3	23	12	Uranus 4°.7 N of Moon		24	00	53	Neptune 3°.8 N of Moon
	4	22	45	NEW MOON		25	09	46	LAST QUARTER
	7	23	35	Mars 3°.2 N of Moon		26	06	49	Moon greatest lat. S 5° 13'
	8	08	14	Mercury 1°.4 S of Uranus		26	22	06	Mercury in descending node
	9	18	51	Moon in ascending node		27	21	31	Uranus 4°.8 N of Moon
	10	05	51	Venus greatest helio lat. S.	July	1	21	45	Venus 1°.6 N of Moon
	12	01	12	FIRST QUARTER		2	19	16	NEW MOON; *Solar Eclipse*
	13	21	53	Moon at perigee		3	06	53	Moon in ascending node
	15	13	30	Moon greatest lat. N 5° 04'		4	05	39	Mars 0°.1 S of Moon
	18	08	14	Venus 1°.2 S of Uranus					*Occultation*
	18	21	11	FULL MOON		4	08	33	Mercury 3°.3 S of Moon
	19	15	26	Mercury in ascending node		4	22	13	Earth at aphelion
	20	16	54	Jupiter 1°.7 S of Moon		5	05	00	Moon at perigee
	21	13	06	Mercury in superior conjunction		5	13	01	Venus in ascending node
				0° 20' N of Sun		7	04	26	Mercury stationary in RA
	22	19	13	Moon in descending node		7	06	55	Mercury at aphelion
	22	22	14	Saturn 0°.5 N of Moon		7	13	33	Mercury 3°.8 S of Mars
				Occultation		9	06	03	Moon greatest lat. N 5° 13'
	24	07	17	Mercury at perihelion		9	10	55	FIRST QUARTER
	26	11	32	Mercury 6°.7 N of *Aldebaran*		9	17	07	Saturn in opposition with Sun

ASTRONOMICAL DIARY, 2019

UNIVERSAL TIME

	d	h	m	
July	13	19	43	Jupiter 2ę.3 S of Moon
	14	14	48	Pluto in opposition with Sun
	16	07	15	Saturn 0ę.2 N of Moon
				Occultation
	16	09	06	Moon in descending node
	16	21	38	FULL MOON; *Lunar Eclipse*
	18	17	59	Mars greatest helio. lat N.
	20	23	59	Moon at apogee
	21	07	44	Neptune 3ę.8 N of Moon
	21	12	35	Mercury in inferior conjunction
				4ę 57' S of Sun
	23	10	29	Moon greatest lat. S 5ę 15'
	23	15	55	Venus 6ę.1 S of *Pollux*
	24	10	30	Mercury 5ę.7 S of Venus
	25	01	18	LAST QUARTER
	25	07	13	Uranus 4ę.8 N of Moon
	26	06	25	Mercury 11ę.6 S of *Pollux*
	27	13	02	Mercury greatest helio lat. S.
	29	23	14	Uranus in square with Sun
	30	17	03	Moon in ascending node
	31	02	18	Mercury 4ę.5 S of Moon
	31	18	42	Mercury stationary in RA
	31	20	36	Venus 0ę.6 S of Moon
Aug.	1	03	12	NEW MOON
	1	19	55	Mars 1ę.7 S of Moon
	2	07	11	Moon at perigee
	5	09	13	Moon greatest lat. N 5ę 11'
	5	22	14	Mercury 9ę.3 S of *Pollux*
	7	17	31	FIRST QUARTER
	8	08	54	Venus at perihelion
	9	22	53	Jupiter 2ę.5 S of Moon
	9	23	08	Mercury greatest elong. W. (19ę.0)
	11	16	27	Jupiter stationary in RA
	12	05	29	Uranus stationary in RA
	12	09	53	Saturn 0ę.04 N of Moon
				Occultation
	12	14	45	Moon in descending node
	14	06	07	Venus in superior conjunction
				1ę 16' N of Sun
	15	12	29	FULL MOON
	15	14	49	Mercury in ascending node
	17	10	49	Moon at apogee
	17	13	13	Neptune 3ę.7 N of Moon
	17	23	26	Mars 0ę.7 N of *Regulus*
	19	13	09	Moon greatest lat. S 5ę 08'
	20	06	34	Mercury at perihelion
	21	04	19	Venus 1ę.0 N of *Regulus*
	21	14	34	Uranus 4ę.7 N of Moon
	23	14	56	LAST QUARTER
Aug.	24	12	34	Venus 0ę.3 N of Mars
	26	01	19	Mars at aphelion
	27	01	48	Moon in ascending node
	29	03	07	Mercury 1ę.4 N of *Regulus*
	30	00	51	Venus greatest helio. lat N.
	30	01	07	Mercury 1ę.9 S of Moon
	30	10	22	Mars 3ę.1 S of Moon
	30	10	37	NEW MOON
	30	11	43	Mercury greatest helio. lat N.
	30	15	53	Moon at perigee
	30	16	18	Venus 2ę.9 S of Moon
Sept.	1	12	38	Moon greatest lat. N 5ę 05'
	2	10	42	Mars in conjunction with Sun
	3	10	44	Mercury 0ę.7 N of Mars
	4	01	41	Mercury in superior conjunction
				1ę 42' N of Sun
	6	03	10	FIRST QUARTER
	6	06	52	Jupiter 2ę.3 S of Moon
	8	13	42	Saturn 0ę.04 N of Moon
				Occultation
	8	15	27	Jupiter in square with Sun
	8	17	37	Moon in descending node
	10	07	24	Neptune in opposition with Sun
	13	13	32	Moon at apogee
	13	17	52	Neptune 3ę.6 N of Moon
	13	21	35	Mercury 0ę.3 S of Venus
	14	04	33	FULL MOON
	15	14	18	Moon greatest lat. S 5ę 00'
	17	19	37	Uranus 4ę.5 N of Moon
	18	06	13	Saturn stationary in RA
	22	02	41	LAST QUARTER
	22	21	29	Mercury in descending node
	23	06	29	Moon in ascending node
	23	07	50	*Autumnal Equinox*
	28	01	19	Mars 4ę.1 S of Moon
	28	02	24	Moon at perigee
	28	15	55	Moon greatest lat. N 4ę 56'
	28	18	26	NEW MOON
	28	22	38	Mercury 1ę.4 N of *Spica*
	29	12	46	Venus 4ę.4 S of Moon
	29	22	01	Mercury 6ę.2 S of Moon
Oct.	2	21	24	Pluto stationary in RA
	3	00	57	Venus 3ę.1 N of *Spica*
	3	06	12	Mercury at aphelion
	3	20	23	Jupiter 1ę.9 S of Moon
	5	16	47	FIRST QUARTER
	5	18	50	Moon in descending node
	5	20	36	Saturn 0ę.3 N of Moon
				Occultation

ASTRONOMICAL DIARY, 2019

UNIVERSAL TIME

	d	h	m			d	h	m	
Oct.	7	19	07	Saturn in square with Sun	Nov.	24	09	02	Mars 4ę.3 S of Moon
	10	18	29	Moon at apogee		24	14	00	Venus 1ę.4 S of Jupiter
	10	22	41	Neptune 3ę.7 N of Moon		25	02	50	Mercury 1ę.9 S of Moon
	12	14	40	Moon greatest lat. S 4ę 57'		26	10	60	Mercury greatest helio. lat N.
	13	21	08	FULL MOON		26	15	06	NEW MOON
	14	07	35	Pluto in square with Sun		27	20	17	Neptune stationary in RA
	14	23	38	Uranus 4ę.4 N of Moon		28	10	29	Mercury greatest elong. W. (20ę.1)
	20	04	02	Mercury greatest elong. E. (24ę.6)		28	10	49	Jupiter 0ę.7 S of Moon
	20	07	28	Moon in ascending node		28	18	28	Venus at aphelion
	21	12	39	LAST QUARTER		28	18	49	Venus 1ę.9 S of Moon
	23	12	20	Mercury greatest helio lat. S.					*Occultation*
	25	02	29	Venus in descending node		29	04	12	Moon in descending node
	26	06	58	Moon greatest lat. N 4ę 57'		29	21	03	Saturn 0ę.9 N of Moon
	26	10	39	Moon at perigee					*Occultation*
	26	16	52	Mars 4ę.5 S of Moon	Dec.	4	06	58	FIRST QUARTER
	28	03	38	NEW MOON		4	12	07	Neptune 4ę.1 N of Moon
	28	08	15	Uranus in opposition with Sun		5	04	08	Moon at apogee
	29	13	32	Venus 3ę.9 S of Moon		6	06	35	Moon greatest lat. S 5ę 11'
	29	14	54	Mercury 6ę.7 S of Moon		8	09	01	Neptune in square with Sun
	30	08	30	Mercury 2ę.7 S of Venus		8	10	31	Uranus 4ę.6 N of Moon
	31	14	22	Jupiter 1ę.3 S of Moon		11	04	41	Venus 1ę.8 S of Saturn
	31	20	17	Mercury stationary in RA		12	05	12	FULL MOON
Nov.	1	21	40	Moon in descending node		13	14	15	Moon in ascending node
	2	07	21	Saturn 0ę.6 N of Moon		15	16	11	Mercury 5ę.1 N of *Antares*
				Occultation		18	20	25	Moon at perigee
	4	10	23	FIRST QUARTER		19	04	57	LAST QUARTER
	7	04	36	Neptune 3ę.9 N of Moon		19	12	12	Moon greatest lat. N 5ę 16'
	7	08	36	Moon at apogee		19	20	48	Mercury in descending node
	8	14	38	Mars 3ę.1 N of *Spica*		20	22	34	Venus greatest helio lat. S.
	8	15	47	Moon greatest lat. S 5ę 03'		22	04	19	*Winter Solstice*
	9	10	36	Venus 4ę.0 N of *Antares*		23	01	49	Mars 3ę.5 S of Moon
	11	04	15	Uranus 4ę.4 N of Moon		25	11	08	Mercury 1ę.9 S of Moon
	11	13	54	Mercury in ascending node		26	05	13	NEW MOON; *Solar Eclipse*
	11	15	22	Mercury in inferior conjunction		26	07	30	Jupiter 0ę.2 S of Moon
				0ę 10' N of Sun		26	13	01	Moon in descending node
				Transit of Mercury		26	16	54	Venus at perihelion
	12	13	34	FULL MOON		27	11	47	Saturn 1ę.2 N of Moon
	16	05	49	Mercury at perihelion		27	18	25	Jupiter in conjunction with Sun
	16	08	48	Moon in ascending node		29	01	31	Venus 1ę.0 N of Moon
	19	21	11	LAST QUARTER					*Occultation*
	20	14	37	Mercury stationary in RA		30	05	28	Mercury at aphelion
	22	09	40	Moon greatest lat. N 5ę 07'		31	07	08	Moon greatest lat. S 4ę 02'
	23	07	41	Moon at perigee		31	21	00	Neptune 4ę.1 N of Moon

TABLE-I
CONVERSION OF MEAN SOLAR INTO SIDEREAL TIME
CORRECTION TO BE *ADDED* TO A MEAN TIME INTERVAL

HOURS			MINUTES				SECONDS			
Mean Time	Correction		Mean Time	Correction	Mean Time	Correction	Mean Time	Correction	Mean Time	Correction
h	m	s	m	s	m	s	s	s	s	s
1	0	09.856	1	0.164	31	5.093	1	.003	31	.085
2	0	19.713	2	0.329	32	5.257	2	.005	32	.088
3	0	29.569	3	0.493	33	5.421	3	.008	33	.090
4	0	39.426	4	0.657	34	5.585	4	.011	34	.093
5	0	49.282	5	0.821	35	5.750	5	.014	35	.096
6	0	59.139	6	0.986	36	5.914	6	.016	36	.099
7	1	08.995	7	1.150	37	6.078	7	.019	37	.101
8	1	18.852	8	1.314	38	6.242	8	.022	38	.104
9	1	28.708	9	1.478	39	6.407	9	.025	39	.107
10	1	38.565	10	1.643	40	6.571	10	.027	40	.110
11	1	48.421	11	1.807	41	6.735	11	.030	41	.112
12	1	58.278	12	1.971	42	6.900	12	.033	42	.115
13	2	08.134	13	2.136	43	7.064	13	.036	43	.118
14	2	17.991	14	2.300	44	7.228	14	.038	44	.120
15	2	27.847	15	2.464	45	7.392	15	.041	45	.123
16	2	37.704	16	2.628	46	7.557	16	.044	46	.126
17	2	47.560	17	2.793	47	7.721	17	.047	47	.129
18	2	57.417	18	2.957	48	7.885	18	.049	48	.131
19	3	07.273	19	3.121	49	8.049	19	.052	49	.134
20	3	17.129	20	3.285	50	8.214	20	.055	50	.137
21	3	26.986	21	3.450	51	8.378	21	.057	51	.140
22	3	36.842	22	3.614	52	8.542	22	.060	52	.142
23	3	46.699	23	3.778	53	8.707	23	.063	53	.145
24	3	56.555	24	3.943	54	8.871	24	.066	54	.148
			25	4.107	55	9.035	25	.068	55	.151
			26	4.271	56	9.199	26	.071	56	.153
			27	4.435	57	9.364	27	.074	57	.156
			28	4.600	58	9.528	28	.077	58	.159
			29	4.764	59	9.692	29	.079	59	.162
			30	4.928	60	9.856	30	.082	60	.164

Local Apparent Sidereal time for any given local mean time
= mean Sid. Time for 0^h U.T. (Pages 13 to 16)
— reduction for longitude of place
+ local mean time reckoned from midnight
+ correction for local mean time added (Table-I)
+ Equation of Equinoxes.

Local apparent Sidereal Time for any hour of Universal Time.
= Sid. Time for 0^h U.T. (Pages 13 to 16)
+ longitude of place (in time)
+ Universal Time
+ correction for U.T. added (Table-I)
+ Equation of Equinoxes.

N.B. The longitude of place is to be taken in time and regarded *positive* for places East of Greenwich. The reduction of Sidereal Time for the longitude of place may be taken from the above table and with the same sign as that of longitude. The correction for the L.M.T. or U.T. added should also be taken from the above table. For details, see the examples given under the EXPLANATION.

TABLE-II
CONVERSION OF SIDEREAL INTO MEAN SOLAR TIME
CORRECTION TO BE *SUBTRACTED* FROM A SIDEREAL TIME INTERVAL

HOURS			MINUTES				SECONDS			
Sidereal Time	Correction		Sidereal Time	Correction	Sidereal Time	Correction	Sidereal Time	Correction	Sidereal Time	Correction
h	m	s	m	s	m	s	s	s	s	s
1	0	09.830	1	0.164	31	5.079	1	.003	31	.085
2	0	19.659	2	0.328	32	5.242	2	.005	32	.087
3	0	29.489	3	0.491	33	5.406	3	.008	33	.090
4	0	39.318	4	0.655	34	5.570	4	.011	34	.093
5	0	49.148	5	0.819	35	5.734	5	.014	35	.096
6	0	58.977	6	0.983	36	5.898	6	.016	36	.098
7	1	08.807	7	1.147	37	6.062	7	.019	37	.101
8	1	18.636	8	1.311	38	6.225	8	.022`	38	.104
9	1	28.466	9	1.474	39	6.389	9	.025	39	.106
10	1	38.296	10	1.638	40	6.553	10	.027	40	.109
11	1	48.125	11	1.802	41	6.717	11	.030	41	.112
12	1	57.955	12	1.966	42	6.881	12	.033	42	.115
13	2	07.784	13	2.130	43	7.045	13	.035	43	.117
14	2	17.614	14	2.294	44	7.208	14	.038	44	.120
15	2	27.443	15	2.457	45	7.372	15	.041	45	.123
16	2	37.273	16	2.621	46	7.536	16	.044	46	.126
17	2	47.103	17	2.785	47	7.700	17	.046	47	.128
18	2	56.932	18	2.949	48	7.864	18	.049	48	.131
19	3	06.762	19	3.113	49	8.027	19	.052	49	.134
20	3	16.591	20	3.277	50	8.191	20	.055	50	.137
21	3	26.421	21	3.440	51	8.355	21	.057	51	.139
22	3	36.250	22	3.604	52	8.519	22	.060	52	.142
23	3	46.080	23	3.768	53	8.683	23	.063	53	.145
24	3	55.909	24	3.932	54	8.847	24	.066	54	.147
			25	4.096	55	9.010	25	.068	55	.150
			26	4.259	56	9.174	26	.071	56	.153
			27	4.423	57	9.338	27	.074	57	.156
			28	4.587	58	9.502	28	.076	58	.158
			29	4.751	59	9.666	29	.079	59	.161
			30	4.915	60	9.830	30	.082	60	.164

Local Mean Time for any given local apparent Sidereal Time
= Time of preceding transit of First Point of Aries (pages 13 to 16)
+ reduction for longitude of place
+ given local apparent Sidereal Time — Equation of Equinoxes
— correction for Sidereal Time added (Table-II).

Otherwise, L.M.T. for any given Sidereal Time may be obtained as follows:-
Given Sidereal Time
— Sidereal Time for 0^h U.T. (pages 13 to 16)
+ reduction for longitude of place
= Sidereal interval since 0^h L.M.T.
This Sidereal interval corrected by the above table gives the required local mean time.

or, Universal Time for any given Sidereal Time may be obtained as follows:-
Given Sidereal Time —longitude of place —Sidereal Time for 0^h U.T. = Sidereal interval since 0^h U.T.
This interval converted into Mean Solar Time by the above table gives the Universal Time required.

N.B. The reduction for longitude of place is of the same sign as that of the longitude, i.e. *positive* for places East of Greenwich and *negative* for West. See Example under EXPLANATION.

TABLE-III
CONVERSION OF ARC TO TIME

DEGREES						MINUTES		SECONDS					
°	h m	°	h m	°	h m	′	m s	″	s	″	s	″	s
0	0 00	49	3 16	98	6 32	0	0 00	0	0.000	0.00	0.000	0.50	0.033
1	0 04	50	3 20	99	6 36	1	0 04	1	0.067	.01	.001	.51	.034
2	0 08	51	3 24	100	6 40	2	0 08	2	0.133	.02	.001	.52	.035
3	0 12	52	3 28	101	6 44	3	0 12	3	0.200	.03	.002	.53	.035
4	0 16	53	3 32	102	6 48	4	0 16	4	0.267	.04	.003	.54	.036
5	0 20	54	3 36	103	6 52	5	0 20	5	0.333	.05	.003	.55	.037
6	0 24	55	3 40	104	6 56	6	0 24	6	0.400	.06	.004	.56	.037
7	0 28	56	3 44	105	7 00	7	0 28	7	0.467	.07	.005	.57	.038
8	0 32	57	3 48	106	7 04	8	0 32	8	0.533	.08	.005	.58	.039
9	0 36	58	3 52	107	7 08	9	0 36	9	0.600	.09	.006	.59	.039
10	0 40	59	3 56	108	7 12	10	0 40	10	0.667	0.10	0.007	0.60	0.040
11	0 44	60	4 00	109	7 16	11	0 44	11	0.733	.11	.007	.61	.041
12	0 48	61	4 04	110	7 20	12	0 48	12	0.800	.12	.008	.62	.041
13	0 52	62	4 08	111	7 24	13	0 52	13	0.867	.13	.009	.63	.042
14	0 56	63	4 12	112	7 28	14	0 56	14	0.933	.14	.009	.64	.043
15	1 00	64	4 16	113	7 32	15	1 00	15	1.000	.15	.010	.65	.043
16	1 04	65	4 20	114	7 36	16	1 04	16	1.067	.16	.011	.66	.044
17	1 08	66	4 24	115	7 40	17	1 08	17	1.133	.17	.011	.67	.045
18	1 12	67	4 28	116	7 44	18	1 12	18	1.200	.18	.012	.68	.045
19	1 16	68	4 32	117	7 48	19	1 16	19	1.267	.19	.013	.69	.046
20	1 20	69	4 36	118	7 52	20	1 20	20	1.333	0.20	0.013	0.70	0.047
21	1 24	70	4 40	119	7 56	21	1 24	21	1.400	.21	.014	.71	.047
22	1 28	71	4 44	120	8 00	22	1 28	22	1.467	.22	.015	.72	.048
23	1 32	72	4 48	121	8 04	23	1 32	23	1.533	.23	.015	.73	.049
24	1 36	73	4 52	122	8 08	24	1 36	24	1.600	.24	.016	.74	.049
25	1 40	74	4 56	123	8 12	25	1 40	25	1.667	.25	.017	.75	.050
26	1 44	75	5 00	124	8 16	26	1 44	26	1.733	.26	.017	.76	.051
27	1 48	76	5 04	125	8 20	27	1 48	27	1.800	.27	.018	.77	.051
28	1 52	77	5 08	126	8 24	28	1 52	28	1.867	.28	.019	.78	.052
29	1 56	78	5 12	127	8 28	29	1 56	29	1.933	.29	.019	.79	.053
30	2 00	79	5 16	128	8 32	30	2 00	30	2.000	0.30	0.020	0.80	0.053
31	2 04	80	5 20	129	8 36	31	2 04	31	2.067	.31	.021	.81	.054
32	2 08	81	5 24	130	8 40	32	2 08	32	2.133	.32	.021	.82	.055
33	2 12	82	5 28	131	8 44	33	2 12	33	2.200	.33	.022	.83	.055
34	2 16	83	5 32	132	8 48	34	2 16	34	2.267	.34	.023	.84	.056
35	2 20	84	5 36	133	8 52	35	2 20	35	2.333	.35	.023	.85	.057
36	2 24	85	5 40	134	8 56	36	2 24	36	2.400	.36	.024	.86	.057
37	2 28	86	5 44	135	9 00	37	2 28	37	2.467	.37	.025	.87	.058
38	2 32	87	5 48	136	9 04	38	2 32	38	2.533	.38	.025	.88	.059
39	2 36	88	5 52	137	9 08	39	2 36	39	2.600	.39	.026	.89	.059
40	2 40	89	5 56	138	9 12	40	2 40	40	2.667	0.40	0.027	0.90	0.06
41	2 44	90	6 00	139	9 16	41	2 44	41	2.733	.41	.027	.91	.061
42	2 48	91	6 04	140	9 20	42	2 48	42	2.800	.42	.028	.92	.061
43	2 52	92	6 08	141	9 24	43	2 52	43	2.867	.43	.029	.93	.062
44	2 56	93	6 12	142	9 28	44	2 56	44	2.933	.44	.029	.94	.063
45	3 00	94	6 16	143	9 32	45	3 00	45	3.000	.45	.030	.95	.063
46	3 04	95	6 20	144	9 36	46	3 04	46	3.067	.46	.031	.96	.064
47	3 08	96	6 24	145	9 40	47	3 08	47	3.133	.47	.031	97	.065
48	3 12	97	6 28	146	9 44	48	3 12	48	3.200	.48	.032	.98	.065

TABLE-III ---- *contd.*
CONVERSION OF ARC TO TIME

DEGREES						MINUTES		SECONDS					
°	h m	°	h m	°	h m	′	m s	″	s	″	s	″	s
147	9 48	158	10 32	169	11 16	49	3 16	49	3.267	0.49	0.033	0.99	0.066
148	9 52	159	10 36	170	11 20	50	3 20	50	3.333	0.50	0.033	1.00	0.067
149	9 56	160	10 40	171	11 24	51	3 24	51	3.400				
150	10 00	161	10 44	172	11 28	52	3 28	52	3.467				
151	10 04	162	10 48	173	11 32	53	3 32	53	3.533				
152	10 08	163	10 52	174	11 36	54	3 36	54	3.600				
153	10 12	164	10 56	175	11 40	55	3 40	55	3.667				
154	10 16	165	11 00	176	11 44	56	3 44	56	3.733				
155	10 20	166	11 04	177	11 48	57	3 48	57	3.800				
156	10 24	167	11 08	178	11 52	58	3 52	58	3.867				
157	10 28	168	11 12	179	11 56	59	3 56	59	3.933				

TABLE-IV
CONVERSION OF TIME TO ARC

	0^h	1^h	2^h	3^h	4^h	5^h	SECONDS					
m	° ′	° ′	° ′	° ′	° ′	° ′	s	′ ″	s	″	s	″
0	0 00	15 00	30 00	45 00	60 00	75 00	0	0 00	0.00	0.00	0.50	7.50
1	0 15	15 15	30 15	45 15	60 15	75 15	1	0 15	.01	0.15	.51	7.65
2	0 30	15 30	30 30	45 30	60 30	75 30	2	0 30	.02	0 30	.52	7.80
3	0 45	15 45	30 45	45 45	60 45	75 45	3	0 45	.03	0.45	.53	7.95
4	1 00	16 00	31 00	46 00	61 00	76 00	4	1 00	.04	0.60	.54	8.10
5	1 15	16 15	31 15	46 15	61 15	76 15	5	1 15	.05	0.75	.55	8.25
6	1 30	16 30	31 30	46 30	61 30	76 30	6	1 30	.06	0.90	.56	8.40
7	1 45	16 45	31 45	46 45	61 45	76 45	7	1 45	.07	1.05	.57	8.55
8	2 00	17 00	32 00	47 00	62 00	77 00	8	2 00	.08	1.20	.58	8.70
9	2 15	17 15	32 15	47 15	62 15	77 15	9	2 15	.09	1.35	.59	8.85
10	2 30	17 30	32 30	47 30	62 30	77 30	10	2 30	0.10	1.50	0.60	9.00
11	2 45	17 45	32 45	47 45	62 45	77 45	11	2 45	.11	1.65	.61	9.15
12	3 00	18 00	33 00	48 00	63 00	78 00	12	3 00	.12	1.80	.62	9.30
13	3 15	18 15	33 15	48 15	63 15	78 15	13	3 15	.13	1.95	.63	9.45
14	3 30	18 30	33 30	48 30	63 30	78 30	14	3 30	.14	2.10	.64	9.60
15	3 45	18 45	33 45	48 45	63 45	78 45	15	3 45	.15	2.25	.65	9.75
16	4 00	19 00	34 00	49 00	64 00	79 00	16	4 00	.16	2.40	.66	9.90
17	4 15	19 15	34 15	49 15	64 15	79 15	17	4 15	.17	2.55	.67	10.05
18	4 30	19 30	34 30	49 30	64 30	79 30	18	4 30	.18	2.70	.68	10.20
19	4 45	19 45	34 45	49 45	64 45	79 45	19	4 45	.19	2.85	.69	10.35
20	5 00	20 00	35 00	50 00	65 00	80 00	20	5 00	.20	3.00	0.70	10.50
21	5 15	20 15	35 15	50 15	65 15	80 15	21	5 15	.21	3.15	.71	10.65
22	5 30	20 30	35 30	50 30	65 30	80 30	22	5 30	.22	3.30	.72	10.80
23	5 45	20 45	35 45	50 45	65 45	80 45	23	5 45	.23	3.45	.73	10.95
24	6 00	21 00	36 00	51 00	66 00	81 00	24	6 00	.24	3.60	.74	11.10
25	6 15	21 15	36 15	51 15	66 15	81 15	25	6 15	.25	3.75	.75	11.25
26	6 30	21 30	36 30	51 30	66 30	81 30	26	6 30	.26	3.90	.76	11.40
27	6 45	21 45	36 45	51 45	66 45	81 45	27	6 45	.27	4.05	.77	11.55
28	7 00	22 00	37 00	52 00	67 00	82 00	28	7 00	.28	4.20	.78	11.70
29	7 15	22 15	37 15	52 15	67 15	82 15	29	7 15	.29	4.35	.79	11.85
30	7 30	22 30	37 30	52 30	67 30	82 30	30	7 30	.30	4.50	0.80	12.00

TABLE-IV ---- *contd.*
CONVERSION OF TIME TO ARC

	0^h	1^h	2^h	3^h	4^h	5^h	SECONDS					
m	° ′	° ′	° ′	° ′	° ′	° ′	s	′ ″	s	″	s	″
31	7 45	22 45	37 45	52 45	67 45	82 45	31	7 45	0.31	4.65	0.81	12.15
32	8 00	23 00	38 00	53 00	68 00	83 00	32	8 00	.32	4.80	.82	12.30
33	8 15	23 15	38 15	53 15	68 15	83 15	33	8 15	.33	4.95	.83	12.45
34	8 30	23 30	38 30	53 30	68 30	83 30	34	8 30	.34	5.10	.84	12.60
35	8 45	23 45	38 45	53 45	68 45	83 45	35	8 45	.35	5.25	.85	12.75
36	9 00	24 00	39 00	54 00	69 00	84 00	36	9 00	.36	5.40	.86	12.90
37	9 15	24 15	39 15	54 15	69 15	84 15	37	9 15	.37	5.55	.87	13.05
38	9 30	24 30	39 30	54 30	69 30	84 30	38	9 30	.38	5.70	.88	13.20
39	9 45	24 45	39 45	54 45	69 45	84 45	39	9 45	.39	5.85	.89	13.35
40	10 00	25 00	40 00	55 00	70 00	85 00	40	10 00	.40	6.00	.90	13.50
41	10 15	25 15	40 15	55 15	70 15	85 15	41	10 15	.41	6.15	.91	13.65
42	10 30	25 30	40 30	55 30	70 30	85 30	42	10 30	.42	6.30	.92	13.80
43	10 45	25 45	40 45	55 45	70 45	85 45	43	10 45	.43	6.45	.93	13.95
44	11 00	26 00	41 00	56 00	71 00	86 00	44	11 00	.44	6.60	.94	14.10
45	11 15	26 15	41 15	56 15	71 15	86 15	45	11 15	.45	6.75	.95	14.25
46	11 30	26 30	41 30	56 30	71 30	86 30	46	11 30	.46	6.90	.96	14.40
47	11 45	26 45	41 45	56 45	71 45	86 45	47	11 45	.47	7.05	.97	14.55
48	12 00	27 00	42 00	57 00	72 00	87 00	48	12 00	.48	7.20	.98	14.70
49	12 15	27 15	42 15	57 15	72 15	87 15	49	12 15	.49	7.35	0.99	14.85
50	12 30	27 30	42 30	57 30	72 30	87 30	50	12 30	0.50	7.50	1.00	15.00
51	12 45	27 45	42 45	57 45	72 45	87 45	51	12 45				
52	13 00	28 00	43 00	58 00	73 00	88 00	52	13 00				
53	13 15	28 15	43 15	58 15	73 15	88 15	53	13 15				
54	13 30	28 30	43 30	58 30	73 30	88 30	54	13 30		h	°	
55	13 45	28 45	43 45	58 45	73 45	88 45	55	13 45		6 =	90	
56	14 00	29 00	44 00	59 00	74 00	89 00	56	14 00		12 =	180	
57	14 15	29 15	44 15	59 15	74 15	89 15	57	14 15		18 =	270	
58	14 30	29 30	44 30	59 30	74 30	89 30	58	14 30				
59	14 45	29 45	44 45	59 45	74 45	89 45	59	14 45				

TABLE - V
CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY

	0^h	1^h	2^h	3^h	4^h	5^h	SECONDS	
m	d	d	d	d	d	d	s	d
0	0.000 000	0.041 667	0.083 333	0.125 000	0.166 667	0.208 333	0	0.000 000
1	.000 694	.042 361	.084 028	.125 694	.167 361	.209 028	1	.000 012
2	.001 389	.043 056	.084 722	.126 389	.168 056	.209 722	2	.000 023
3	.002 083	.043 750	.085 417	.127 083	.168 750	.210 417	3	.000 035
4	.002 778	.044 444	.086 111	.127 778	.169 444	.211 111	4	.000 046
5	.003 472	.045 139	.086 806	.128 472	.170 139	.211 806	5	.000 058
6	.004 167	.045 833	.087 500	.129 167	.170 833	.212 500	6	.000 069
7	.004 861	.046 528	.088 194	.129 861	.171 528	.213 194	7	.000 081
8	.005 556	.047 222	.088 889	.130 556	.172 222	.213 889	8	.000 093
9	.006 250	.047 917	.089 583	.131 250	.172 917	.214 583	9	.000 104
10	0.006 944	0.048 611	0.090 278	0.131 944	0.173 611	0.215 278	10	0.000 116
11	.007 639	.049 306	.090 972	0.132 639	.174 306	.215 972	11	.000 127

TABLE - V ---- *contd.*
CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY

	0^h	1^h	2^h	3^h	4^h	5^h	SECONDS	
m	d	d	d	d	d	d	s	d
12	0.008 333	0.050 000	0.091 667	0.133 333	0.175 000	0.216 667	12	0.000 139
13	.009 028	.050 694	.092 361	.134 028	.175 694	.217 361	13	.000 150
14	.009 722	.051 389	.093 056	.134 722	.176 389	.218 056	14	.000 162
15	.010 417	.052 083	.093 750	.135 417	.177 083	.218 750	15	.000 174
16	.011 111	.052 778	.094 444	.136 111	.177 778	.219 444	16	.000 185
17	.011 806	.053 472	.095 139	.136 806	. 178 472	.220 139	17	.000 197
18	.012 500	.054 167	.095 833	.137 500	.179 167	.220 833	18	.000 208
19	.013 194	.054 861	.096 528	.138 194	.179 861	.221 528	19	.000 220
20	0.013 889	0.055 556	0.097 222	0.138 889	0.180 556	0.222 222	20	0.000 231
21	.014 583	056 250	.097 917	.139 583	.181 250	.222 917	21	.000 243
22	.015 278	.056 944	.098 611	.140 278	.181 944	.223 611	22	.000 255
23	.015 972	.057 639	.099 306	.140 972	182 639	.224 306	23	.000 266
24	.016 667	.058 333	.100 000	.141 667	.183 333	.225 000	24	.000 278
25	.017 361	.059 028	.100 694	.142 361	.184 028	.225 694	25	.000 289
26	.018 056	.059 722	.101 389	.143 056	.184 722	.226 389	26	.000 301
27	.018 750	.060 417	.102 083	.143 750	.185 417	.227 083	27	.000 312
28	.019 444	.061 111	.102 778	.144 444	.186 111	.227 778	28	.000 324
29	.020 139	.061 806	.103 472	.145 139	.186 806	.228 472	29	.000 336
30	0.020 833	0.062 500	0.104 167	0.145 833	0.187 500	0.229 167	30	0.000 347
31	.021 528	.063 194	.104 861	.146 528	.188 194	.229 861	31	.000 359
32	.022 222	.063 889	.105 556	.147 222	.188 889	.230 556	32	.000370
33	.022 917	.064 583	.106 250	.147 917	.189 583	.231 250	33	.000 382
34	.023 611	.065 278	.106 944	.148 611	.190 278	.231 944	34	.000 394
35	.024 306	.065 972	.107 639	.149 306	.190 972	.232 639	35	.000 405
36	.025 000	.066 667	.108 333	.150 000	.191 667	.233 333	36	.000 417
37	.025 694	.067 361	.109 028	.150 694	.192 361	.234 028	37	.000 428
38	.026 389	.068 056	.109 722	.151 389	.193 056	.234 722	38	.000 440
39	.027 083	.068 750	.110 417	.152 083	.193 750	.235 417	39	.000 451
40	0.027 778	0.069 444	0.111 111	0.152 778	0.194 444	0.236 111	40	0.000 463
41	.028 472	.070 139	.111 806	.153 472	.195 139	.236 806	41	.000 475
42	.029 167	.070 833	.112 500	.154 167	.195 833	.237 500	42	.000 486
43	.029 861	.071 528	.113 194	.154 861	.196 528	.238 194	43	.000 498
44	.030 556	.072 222	.113 889	.155 556	.197 222	.238 889	44	.000 509
45	.031 250	.072 917	.114 583	.156 250	.197 917	.239 583	45	.000 521
46	.031 944	.073 611	.115 278	.156 944	.198 611	.240 278	46	.000 532
47	.032 639	.074 306	.115 972	.157 639	.199 306	.240 972	47	.000 544
48	.033 333	.075 000	.116 667	.158 333	.200 000	.241 667	48	.000 556
49	.034 028	.075 694	.117 361	.159 028	.200 694	.242 361	49	.000 567
50	0.034 722	0.076 389	0.118 056	0.159 722	0.201 389	0.243 056	50	0.000 579
51	.035 417	.077 083	.118 750	.160 417	.202 083	.243 750	51	.000 590
52	.036 111	.077 778	.119 444	.161 111	.202 778	.244 444	52	.000 602
53	.036 806	.078 472	.120 139	.161 806	.203 472	.245 139	53	.000 613
54	.037 500	.079 167	.120 833	.162 500	.204 167	.245 833	54	.000 625
55	.038 194	.079 861	.121 528	.163 194	.204 861	.246 528	55	.000 637
56	.038 889	.080 556	.122 222	.163 889	.205 556	.247 222	56	.000 648
57	.039 583	.081 250	.122 917	.164 583	.206 250	.247 917	57	.000 660
58	.040 278	.081 944	.123 611	.165 278	.206 944	.248 611	58	.000 671
59	0.040 972	0.082 639	0.124 306	0.165 972	0.207 639	0.249 306	59	0.000 683

TABLE - V ---- *contd.*
CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY

	6^h	7^h	8^h	9^h	10^h	11^h	SECONDS	
m	d	d	d	d	d	d	s	d
0	0.250 000	0.291 667	0.333 333	0.375 000	0.416 667	0.458 333	0	0.000 000
1	.250 694	.292 361	.334 028	.375 694	. 417 361	.459 028	1	.000 012
2	.251 389	.293 056	.334 722	.376 389	.418 056	.459 722	2	.000 023
3	.252 083	.293 750	.335 417	.377 083	.418 750	.460 417	3	.000 035
4	.252 778	.294 444	.336 111	.377 778	.419 444	.461 111	4	.000 046
5	.253 472	.295 139	.336 806	.378 472	.420 139	.461 806	5	.000 058
6	.254 167	.295 833	.337 500	.379 167	.420 833	.462 500	6	.000 069
7	.254 861	.296 528	338 194	.379 861	.421 528	. 463 194	7	.000 081
8	.255 556	.297 222	.338 889	.380 556	.422 222	. 463 889	8	.000 093
9	.256 250	.297 917	.339 583	.381 250	.422 917	.464 583	9	.000 104
10	0.256 944	0.298 611	0.340 278	0.381 944	0.423 611	0.465 278	10	0.000 116
11	.257 639	.299 306	.340 972	.382 639	.424 306	.465 972	11	.000 127
12	.258 333	.300 000	.341 667	.383 333	.425 000	.466 667	12	.000 139
13	.259 028	.300 694	.342 361	384 028	.425 694	.467 361	13	.000 150
14	.259 722	.301 389	.343 056	.384 722	.426 389	.468 056	14	.000 162
15	.260 417	.302 083	.343 750	.385 417	.427 083	.468 750	15	.000 174
16	.261 111	.302 778	.344 444	.386 111	.427 778	.469 444	16	.000 185
17	.261 806	.303 472	.345 139	.386 806	.428 472	.470 139	17	.000 197
18	.262 500	.304 167	.345 833	.387 500	.429 167	.470 833	18	.000 208
19	.263 194	.304 861	.346 528	.388 194	.429 861	.471 528	19	.000 220
20	0.263 889	0.305 556	0.347 222	0.388 889	0.430 556	0.472 222	20	0.000 231
21	.264 583	.306 250	.347 917	.389 583	.431 250	.472 917	21	.000 243
22	.265 278	.306 944	.348 611	.390 278	.431 944	.473 661	22	.000 255
23	.265 972	.307 639	.349 306	.390 972	.432 639	.474 306	23	.000 266
24	.266 667	.308 383	.350 000	.391 667	.433 333	.475 000	24	.000 278
25	.267 361	.309 028	.350 694	.392 361	.434 028	.475 694	25	.000289
26	.268 056	.309 722	.351 389	.393 056	.434 722	.476 389	26	.000 301
27	.268 750	.310 417	.352 083	.393 750	.435 417	.477 083	27	.000 312
28	.269 444	.311 111	.352 778	.394 444	.436 111	.477 778	28	.000 324
29	.270 139	.311 806	.353 472	.395 139	.436 806	.478 472	29	.000 336
30	0.270 833	0.312 500	0.354 167	0.395 833	0.437 500	0.479 167	30	0.000 347
31	.271 528	.313 194	.354 861	.396 528	.438 194	.479 861	31	.000 359
32	.272 222	.313 889	.355 556	.397 222	.438 889	.480 556	32	.000 370
33	.272 917	.314 583	.356 250	.397 917	.439 583	.481 250	33	.000 382
34	.273 611	.315 278	.356 944	.398 611	.440 278	.481 944	34	.000 394
35	.274 306	.315 972	.357 639	.399 306	.440 972	.482 639	35	.000 405
36	.275 000	.316 667	.358 333	.400 000	.441 667	.483 333	36	.000 417
37	.275 694	.317 361	.359 028	.400 694	.442 361	.484 028	37	.000 428
38	276 389	.318 056	.359 722	.401 389	.443 056	.484 722	38	.000 440
39	.277 083	.318 750	.360 417	.402 083	.443 750	.485 417	39	.000 451
40	0.277 778	0.319 444	0.361 111	0.402 778	0.444 444	0.486 111	40	0.000 463
41	.278 472	.320 139	.361 806	.403 472	.445 139	.486 806	41	.000 475
42	279 167	.320 833	.362 500	.404 167	.445 833	.487 500	42	.000 486
43	.279 861	.321 528	.363 194	.404 861	.446 528	.488 194	43	.000 498
44	.280 556	.322 222	.363 889	.405 556	.447 222	.488 889	44	.000 509
45	.281 250	.322 917	.364 583	.406 250	.447 917	.489 583	45	.000 521
46	0.281 944	0.323 611	0.365 278	0.406 944	0.448 611	0.490 278	46	0.000 532

TABLE - V ---- *contd.*
CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY

	6^h	7^h	8^h	9^h	10^h	11^h	SECONDS	
m	d	d	d	d	d	d	s	d
47	0.282 639	0.324 306	0.365 972	0.407 639	0.449 306	0.490 972	47	0.000 544
48	.283 333	.325 000	.366 667	.408 333	.450 000	.491 667	48	.000 556
49	.284 028	.325 694	.367 361	.409 028	.450 694	.492 361	49	.000 567
50	0.284 722	0.326 389	0.368 056	0.409 722	0.451 389	0.493 056	50	0.000 579
51	.285 417	.327 083	.368 750	.410 417	.452 083	.493 750	51	.000 590
52	.286 111	.327 778	.369 444	.411 111	.452 778	.494 444	52	.000 602
53	.286 806	.328 472	. 370 139	.411 806	.453 472	.495 139	53	.000 613
54	.287 500	.329 167	.370 833	.412 500	.454 167	.495 833	54	.000 625
55	.288 194	.329 861	.371 528	.413 194	.454 861	.496 528	55	.000 637
56	.288 889	.330 556	.372 222	.413 889	.455 556	.497 222	56	.000 648
57	.289 583	.331 250	.372 917	.414 583	.456 250	.497 917	57	.000 660
58	.290 278	.331 944	.373 611	.415 278	.456 944	.498 611	58	.000 671
59	0.290 972	0.332 639	0.374 306	0.415 972	0.457 639	0.499 306	59	0.000 683

TABLE - VI
CONVERSION OF MINUTES AND SECONDS TO DECIMALS OF A DEGREE

	0′	1′	2′	3′	4′	5′		
″	°	°	°	°	°	°	″	°
0	0.00000	0.01667	0.03333	0.05000	0.06667	0.08333	0	0.0
1	0028	1694	3361	5028		8361	6	0.1
2	0056	1722	3389	5056	6722	8389	12	0.2
3	0083	1750	3417	5083	6750	8417	18	0.3
4	0111	1778	3444	5111	6778	8444	24	0.4
5	0139	1806	3472	5139	6806	8472	30	0.5
6	0167	1833	3500	5167	6833	8500	36	0.6
7	0194	1861	3528	5194	6861	8528	42	0.7
8	0222	1889	3556	5222	6889	8556	48	0.8
9	0250	1917	3583	5250	6917	8583	54	0.9
10	0.00278	0.01944	0.03611	0.05278	0.06944	0.08611		
11	0306	1972	3639	5306	6972	8639		
12	0333	2000	3667	5333	7000	8667		
13	0361	2028	3694	5361	7028	8694		
14	0389	2056	3722	5389	7056	8722		
15	0417	2083	3750	5417	7083	8750		
16	0444	2111	3778	5444	7111	8778		
17	0472	2139	3806	5472	7139	8806		
18	0500	2167	3833	5500	7167	8833		
19	0528	2194	3861	5528	7194	8861		
20	0.00556	0.02222	0.03889	0.05556	0.07222	0.08889		
21	0583	2250	3917	5583	7250	8917		
22	0611	2278	3944	5611	7278	8944		
23	0639	2306	3972	5639	7306	8972		
24	0667	2333	4000	5667	7333	9000		
25	0.00694	0.02361	0.04028	0.05694	0.07361	0.09028		

TABLE - VI ---- *contd.*
CONVERSION OF MINUTES AND SECONDS TO DECIMALS OF A DEGREE

	0′	1′	2′	3′	4′	5′	In units of the fifth decimal of a Degree.	
″	°	°	°	°	°	°	″	°
26	0.00722	0.02389	0.04056	0.05722	0.07389	0.09056	0.00	0
27	0750	2417	4083	5750	7417	9083	.01	1
28	0778	2444	4111	5778	7444	9111	.05	2
29	0806	2472	4139	5806	7472	9139	.09	3
30	0.00833	0.02500	0.04167	0.05833	0.07500	0.09167	.12	4
31	0861	2528	4194	5861	7528	9194	.16	5
32	0889	2556	4222	5889	7556	9222	.19	6
33	0917	2583	4250	5917	7583	9250	.23	7
34	0944	2611	4278	5944	7611	9278	.26	8
35	0972	2639	4306	5972	7639	9306	.30	9
36	1000	2667	4333	6000	7667	9333	.34	10
37	1028	2694	4361	6028	7694	9361	.37	11
38	1056	2722	4389	6056	7722	9389	.41	12
39	1083	2750	4417	6083	7750	9417	.45	13
40	0.01111	0.02778	0.04444	0.06111	0.07778	0.09444	.48	14
41	1139	2806	4472	6139	7806	9472	.52	15
42	1167	2833	4500	6167	7833	9500	.55	16
43	1194	2861	4528	6194	7861	9528	.59	17
44	1222	2889	4556	6222	7889	9556	.62	18
45	1250	2917	4583	6250	7917	9583	.66	19
46	1278	2944	4611	6278	7944	9611	.70	20
47	1306	2972	4639	6306	7972	9639	.73	21
48	1333	3000	4667	6333	8000	9667	.77	22
49	1361	3028	4694	6361	8028	9694	.81	23
50	0.01389	0.03056	0.04722	0.06389	0.08056	0.09722	.84	24
51	1417	3083	4750	6417	8083	9750	.88	25
52	1444	3111	4778	6444	8111	9778	.91	26
53	1472	3139	4806	6472	8139	9806	.95	27
54	1500	3167	4833	6500	8167	9833	0.98	28
55	1528	3194	4861	6528	8194	9861	1.00	
56	1556	3222	4889	6556	8222	9889		
57	1583	3250	4917	6583	8250	9917	*In critical*	
58	1611	3278	4944	6611	8278	9944	*cases ascend*	
59	0.01639	0.03306	0.04972	0.06639	0.08306	0.09972		

TABLE - VII
INTERPOLATION COEFFICIENTS

n	*B*″	E_0″	E_1″	n	*B*″	E_0″	E_1″
0.00	0.00000	0.00000	0.00000	0.05	0.01188	0.01544	0.00831
.01	.00248	.00328	.00167	.06	0.01410	0.01824	0.00996
.02	.00490	.00647	.00333	.07	.01628	.02094	.01161
.03	.00728	.00955	.00500	.08	.01840	.02355	.01325
.04	.00960	.01254	.00666	.09	.02048	.02607	.01488
0.05	0.01188	0.01544	0.00831	0.10	0.02250	0.02850	0.01650

TABLE - VII ---- *contd.*
INTERPOLATION COEFFICIENTS

n	*B″*	*E₀″*	*E₁″*	n	*B″*	*E₀″*	*E₁″*
0.10	0.02250	0.02850	0.01650	0.55	0.06188	0.05981	0.06394
.11	.02448	.03084	.01811	.56	0.06160	0.05914	0.06406
.12	.02640	.03309	.01971	.57	.06128	.05842	.06413
.13	.02828	.03525	.02130	.58	.06090	.05765	.06415
.14	.03010	.03732	.02288	.59	.06048	.05685	.06410
.15	.03188	.03931	.02444	0.60	0.06000	0.05600	0.06400
.16	.03360	.04122	.02598	.61	.05948	.05511	.06384
.17	.03528	.04304	.02751	.62	.05890	.05419	.06361
.18	.03690	.04477	.02903	.63	.05828	.05322	.06333
.19	.03848	.04643	.03052	.64	.05760	.05222	.06298
0.20	0.04000	0.04800	0.03200	.65	.05688	.05119	.06256
.21	.04148	.04949	.03346	.66	.05610	.05012	.06208
.22	.04290	.05091	.03489	.67	.05528	.04901	.06154
.23	.04428	.05224	.03631	.68	.05440	.04787	.06093
.24	.04560	.05350	.03770	.69	.05348	.04670	.06025
.25	.04688	.05469	.03906	0.70	0.05250	0.04550	0.05950
.26	.04810	.05580	.04040	.71	.05148	.04427	.05868
.27	.04928	.05683	.04172	.72	.05040	.04301	.05779
.28	.05040	.05779	.04301	.73	.04928	.04172	.05683
.29	.05148	.05868	.04427	.74	.04810	.04040	.05580
0.30	0.05250	0.05950	0.04550	.75	.04688	.03906	.05469
.31	.05348	.06025	.04670	.76	.04560	.03770	.05350
.32	.05440	.06093	.04787	.77	.04428	.03631	.05224
.33	.05528	.06154	.04901	.78	.04290	.03489	.05091
.34	.05610	.06208	.05012	.79	.04148	.03346	.04949
.35	.05688	.06256	.05119	0.80	0.04000	0.03200	0.04800
.36	.05760	.06298	.05222	.81	. 03848	.03052	.04643
.37	.05828	.06333	.05322	.82	.03690	.02903	.04477
.38	.05890	.06361	.05419	.83	.03528	.02751	.04304
.39	.05948	.06384	.05511	.84	.03360	.02598	.04122
0.40	0.06000	0.06400	0.05600	.85	.03188	.02444	.03931
.41	.06048	.06410	.05685	.86	.03010	.02288	.03732
.42	.06090	.06415	.05765	.87	.02828	.02130	.03525
.43	.06128	.06413	.05842	.88	.02640	.01971	.03309
.44	.06160	.06406	.05914	.89	.02448	.01811	.03084
.45	.06188	.06394	.05981	0.90	0.02250	0.01650	0.02850
.46	.06210	.06376	.06044	.91	.02048	.01488	.02607
.47	.06228	.06352	.06103	.92	.01840	.01325	.02355
.48	.06240	.06323	.06157	.93	.01628	.01161	.02094
.49	.06248	.06289	.06206	.94	.01410	.00996	.01824
0.50	0.06250	0.06250	0.06250	.95	.01188	.00831	.01544
.51	.06248	.06206	.06289	.96	.00960	.00666	.01254
.52	.06240	.06157	.06323	.97	.00728	.00500	.00955
.53	.06228	.06103	.06352	.98	.00490	.00333	.00647
.54	.06210	.06044	.06376	0.99	.00248	.00167	.00328
0.55	0.06188	0.05981	0.06394	1.00	0.00000	0.00000	0.00000

N.B. – The coefficients are all *negative*. For details about Bessel's and Everett's interpolation formula, please *see* Explanation

TABLE - VIII
EVERETT COEFFICIENTS OF THE SECOND DIFFERENCES

(*The coefficients are all negative*)

n	E_0''	E_1''		n	E_0''	E_1''		n	E_0''	E_1''	
0.000			1.000	0.050			0.950	0.100			0.900
	0.0002	0.0001			0.0156	0.0084			0.0286	0.0166	
.001			0.999	.051			.949	.101			.899
	.0005	.0002			.0159	.0086			.0289	.0167	
.002			.998	.052			.948	.102			.898
	.0008	.0004			.0161	.0087			.0291	.0169	
.003			.997	.053			.947	.103			.897
	.0012	.0006			.0164	.0089			.0293	.0171	
.004			.996	.054			.946	.104			.896
	.0015	.0007			.0167	.0091			.0296	.0172	
.005			.995	.055			.945	.105			.895
	.0018	.0009			.0170	.0092			.0298	.0174	
.006			.994	.056			.944	.106			.894
	.0021	.0011			.0173	.0094			.0300	.0175	
.007			.993	.057			.943	.107			.893
	.0025	.0012			.0175	.0096			.0303	.0177	
.008			.992	.058			.942	.108			.892
	.0028	.0014			.0178	.0097			.0305	.0179	
.009			.991	.059			.941	.109			.891
	.0031	.0016			.0181	.0099			.0307	.0180	
.010			.990	.060			.940	.110			.890
	.0034	.0017			.0184	.0100			.0310	.0182	
.011			.989	.061			.939	.111			.889
	.0038	.0019			.0186	.0102			.0312	.0184	
.012			.988	.062			.938	.112			.888
	.0041	.0021			.0189	.0104			.0314	.0185	
.013			.987	.063			.937	.113			.887
	.0044	.0022			.0192	.0105			.0316	.0187	
.014			.986	.064			.936	.114			.886
	.0047	.0024			.0195	.0107			.0319	.0188	
.015			.985	.065			.935	.115			.885
	.0050	.0026			.0197	.0109			.0321	.0190	
.016			.984	.066			.934	.116			.884
	.0054	.0027			.0200	.0110			.0323	.0192	
.017			.983	.067			.933	.117			.883
	.0057	.0029			.0203	.0112			.0325	.0193	
.018			.982	.068			.932	.118			.882
	.0060	.0031			.0205	.0114			.0328	.0195	
.019			.981	.069			.931	.119			.881
	.0063	.0032			.0208	.0115			.0330	.0196	
.020			.980	.070			.930	.120			.880
	.0066	.0034			.0211	.0117			.0332	.0198	
.021			.979	.071			.929	.121			.879
	.0069	.0036			.0213	.0119			.0334	.0200	
.022			.978	.072			.928	.122			.878
	.0072	.0037			.0216	.0120			.0336	.0201	
.023			.977	.073			.927	.123			.877
	.0076	.0039			.0219	.0122			.0339	.0203	
.024			.976	.074			.926	.124			.876
	.0079	.0041			.0221	.0123			.0341	.0204	
.025			.975	.075			.925	.125			.875
	.0082	.0042			.0224	.0125			.0343	.0206	
.026			.974	.076			.924	.126			.874
	.0085	.0044			.0226	.0127			.0345	.0207	
.027			.973	.077			.923	.127			.873
	.0088	.0046			.0229	.0128			.0347	.0209	
.028			.972	.078			.922	.128			.872
	.0091	.0047			.0232	.0130			.0349	.0211	
.029			.971	.079			.921	.129			.871
	.0094	.0049			.0234	.0132			.0351	.0212	
.030			.970	.080			.920	.130			.870
	.0097	.0051			.0237	.0133			.0354	.0214	
.031			.969	.081			.919	.131			.869
	.0100	.0052			.0239	.0135			.0356	.0215	
.032			.968	.082			.918	.132			.868
	.0103	.0054			.0242	.0137			.0358	.0217	
.033			.967	.083			.917	.133			.867
	.0106	.0056			.0244	.0138			.0360	.0219	
.034			.966	.084			.916	.134			.866
	.0109	.0057			.0247	.0140			.0362	.0220	
.035			.965	.085			.915	.135			.865
	.0112	.0059			.0249	.0141			.0364	.0222	
.036			.964	.086			.914	.136			.864
	.0115	.0061			.0252	.0143			.0366	.0223	
.037			.963	.087			.913	.137			.863
	.0118	.0062			.0255	.0145			.0368	.0225	
.038			.962	.088			.912	.138			.862
	.0121	.0064			.0257	.0146			.0370	.0226	
.039			.961	.089			.911	.139			.861
	.0124	.0066			.0259	.0148			.0372	.0228	
.040			.960	.090			.910	.140			.860
	.0127	.0067			.0262	.0150			.0374	.0230	
.041			.959	.091			.909	.141			.859
	.0130	.0069			.0264	.0151			.0376	.0231	
.042			.958	.092			.908	.142			.858
	.0133	.0071			.0267	.0153			.0378	.0233	
.043			.957	.093			.907	.143			.857
	.0136	.0072			.0269	.0154			.0380	.0234	
.044			.956	.094			.906	.144			.856
	.0139	.0074			.0272	.0156			.0382	.0236	
.045			.955	.095			.905	.145			.855
	.0141	.0076			.0274	.0158			.0384	.0237	
.046			.954	.096			. 904	.146			.854
	.0144	.0077			.0277	.0159			.0386	.0239	
.047			.953	.097			.903	.147			.853
	.0147	.0079			.0279	.0161			.0388	.0240	
.048			.952	.098			.902	.148			.852
	.0150	.0081			.0281	.0163			.0390	.0242	
.049			.951	.099			.901	.149			.851
	0.0153	0.0082			0.0284	0.0164			0.0392	0.0244	
0.050			0.950	0.100			0.900	0.150			0.850
	E_1''	E_0''	n		E_1''	E_0''	n		E_1''	E_0''	n

Formula : $f_n = f_0 + n\,\Delta'_{1/2} + E_0''\Delta_0'' + E_1''\Delta_1''$

TABLE - VIII ---- *contd.*

EVERETT COEFFICIENTS OF THE SECOND DIFFERENCES

(*The coefficients are all negative*)

n	E_0''	E_1''		n	E_0''	E_1''		n	E_0''	E_1''	
0.150	0.0394	0.0245	0.850	0.200	0.0482	0.0321	0.800	0.300	0.0597	0.0457	0.700
.151	.0396	.0247	.849	.202	.0485	.0324	.798	.304	.0600	.0462	.696
.152	.0398	.0248	.848	.204	.0488	.0327	.796	.308	.0602	.0467	.692
.153	.0400	.0250	.847	.206	.0491	.0330	.794	.312	.0605	.0472	.688
.154	.0402	.0251	.846	.208	.0493	.0333	.792	.316	.0608	.0476	.684
.155	.0404	.0253	.845	.210	.0496	.0336	.790	.320	.0611	.0481	.680
.156	.0406	.0254	.844	.212	.0499	.0339	.788	.324	.0613	.0486	.676
.157	.0407	.0256	.843	.214	.0502	.0342	.786	.328	.0615	.0490	.672
.158	.0409	.0258	.842	.216	.0505	.0345	.784	.332	.0618	.0495	.668
.159	.0411	.0259	.841	.218	.0508	.0347	.782	.336	.0620	.0499	.664
.160	.0413	.0261	.840	.220	.0510	.0350	.780	.340	.0622	.0503	.660
.161	.0415	.0262	.839	.222	.0513	.0353	.778	.344	.0624	.0508	.656
.162	.0417	.0264	.838	.224	.0516	.0356	.776	.348	.0626	.0512	.652
.163	.0419	.0265	.837	.226	.0519	.0359	.774	.352	.0627	.0516	.648
.164	.0420	.0267	.836	.228	.0521	.0362	.772	.356	.0629	.0520	.644
.165	.0422	.0268	.835	.230	.0524	.0364	.770	.360	.0631	.0524	.640
.166	.0424	.0270	.834	.232	.0526	.0367	.768	.364	.0632	.0528	.636
.167	.0426	.0271	.833	.234	.0529	.0370	.766	.368	.0633	.0532	.632
.168	.0428	.0273	.832	.236	.0531	.0373	.764	.372	.0634	.0536	.628
.169	.0429	.0274	.831	.238	.0534	.0376	.762	.376	.0636	.0540	.624
.170	.0431	.0276	.830	.240	.0536	.0378	.760	.380	.0637	.0544	.620
.171	.0433	.0277	.829	.242	.0539	.0381	.758	.384	.0638	.0547	.616
.172	.0435	.0279	.828	.244	.0541	.0384	.756	.388	.0638	.0551	.612
.173	.0437	.0280	.827	.246	.0543	.0387	.754	.392	.0639	.0555	.608
.174	.0438	.0282	.826	.248	.0546	.0389	.752	.396	.0640	.0558	.604
.175	.0440	.0283	.825	.250	.0548	.0392	.750	.400	.0640	.0562	.600
.176	.0442	.0285	.824	.252	.0550	.0395	.748	.404	.0641	.0565	.596
.177	.0443	.0287	.823	.254	.0553	.0397	.746	.408	.0641	.0568	.592
.178	.0445	.0288	.822	.256	.0555	.0400	.744	.412	.0641	.0572	.588
.179	.0447	.0290	.821	.258	.0557	.0403	.742	.416	.0641	.0575	.584
.180	.0449	.0291	.820	.260	.0559	.0405	.740	.420	.0641	.0578	.580
.181	.0450	.0293	.819	.262	.0561	.0408	.738	.424	.0641	.0581	.576
.182	.0452	.0294	.818	.264	.0563	.0411	.736	.428	.0641	.0584	.572
.183	.0454	.0296	.817	.266	.0565	.0413	.734	.432	.0641	.0587	.568
.184	.0455	.0297	.816	.268	.0567	.0416	.732	.436	.0641	.0590	.564
.185	.0457	.0299	.815	.270	.0569	.0418	.730	.440	.0640	.0593	.560
.186	.0459	.0300	.814	.272	.0571	.0421	.728	.444	.0640	.0595	.556
.187	.0460	.0302	.813	.274	.0573	.0424	.726	.448	.0639	.0598	.552
.188	.0462	.0303	.812	.276	.0575	.0426	.724	.452	.0639	.0601	.548
.189	.0463	.0304	.811	.278	.0577	.0429	.722	.456	.0638	.0603	.544
.190	.0465	.0306	.810	.280	.0579	.0431	.720	.460	.0637	.0606	.540
.191	.0467	.0307	.809	.282	.0581	.0434	.718	.464	.0636	.0608	.536
.192	.0468	.0309	.808	.284	.0582	.0436	.716	.468	.0635	.0610	.532
.193	.0470	.0310	.807	.286	.0584	.0439	.714	.472	.0634	.0613	.528
.194	.0471	.0312	.806	.288	.0586	.0441	.712	.476	.0633	.0615	.524
.195	.0473	.0313	.805	.290	.0588	.0444	.710	.480	.0632	.0617	.520
.196	.0475	.0315	.804	.292	.0589	.0446	.708	.484	.0630	.0619	.516
.197	.0476	.0316	.803	.294	.0591	.0449	.706	.488	.0629	.0621	.512
.198	.0478	.0318	.802	.296	.0593	.0451	.704	.492	.0627	.0622	.508
.199	0.0479	0.0319	.801	.298	0.0594	0.0454	.702	.496	0.0626	0.0624	.504
0.200			0.800	0.300			0.700	0.500			0.500
	E_1''	E_0''	n		E_1''	E_0''	n		E_1''	E_0''	n

N. B. -- The table is to be used like a critical table without interpolation

TABLE - IX
JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON OF JANUARY 0

Yr. A.D.	100	200	300	400	500	600	700	800	900	1000
0	175 7582	179 4107	183 0632	186 7157	190 3682	194 0207	197 6732	201 3257	204 9782	208 6307
20	176 4887	180 1412	183 7937	187 4462	191 0987	194 7512	198 4037	202 0562	205 7087	209 3612
40	177 2192	180 8717	184 5242	188 1767	191 8292	195 4817	199 1342	202 7867	206 4392	210 0917
60	177 9497	181 6022	185 2547	188 9072	192 5597	196 2122	199 8647	203 5172	207 1697	210 8222
80	178 6802	182 3327	185 9852	189 6377	193 2902	196 9427	200 5952	204 2477	207 9002	211 5527
Yr. A.D.	**1100**	**1200**	**1300**	**1400**	**1500**	**1600**	**1700**	**1800**	**1900**	**2000**
							*	*	*	
0	212 2832	215 9357	219 5882	223 2407	226 8932	230 5447	234 1971	237 8495	241 5020	245 1544
20	213 0137	216 6662	220 3187	223 9712	227 6237	231 2752	234 9276	238 5806	242 2324	245 8849
40	213 7442	217 3967	221 0492	224 7017	228 3542	232 0057	235 6581	239 3105	242 9629	246 6154
60	214 4747	218 1272	221 7797	225 4322	229 0847	232 7362	236 3886	240 0410	243 6934	247 3459
80	215 2052	218 8577	222 5102	226 1627	229 8152	233 4667	237 1191	240 7715	244 4239	248 0764
					†					
100	215 9357	219 5882	223 2407	226 8932	230 5447	234 1971	237 8495	241 5020	245 1544	248 8069

NUMBER OF DAYS TO BE ADDED TO REDUCE TO THE BEGINNING OF EACH MONTH

Year	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	Jun. 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
	*	*										
0	0	31	60	91	121	152	182	213	244	274	305	335
1	366	397	425	456	486	517	547	578	609	639	670	700
2	731	762	790	821	851	882	912	943	974	1004	1035	1065
3	1096	1127	1155	1186	1216	1247	1277	1308	1339	1369	1400	1430
4	1461	1492	1521	1552	1582	1613	1643	1674	1705	1735	1766	1796
5	1827	1858	1886	1917	1947	1978	2008	2039	2070	2100	2131	2161
6	2192	2223	2251	2282	2312	2343	2373	2404	2435	2465	2496	2526
7	2557	2588	2616	2647	2677	2708	2738	2769	2800	2830	2861	2891
8	2922	2953	2982	3013	3043	3074	3104	3135	3166	3196	3227	3257
9	3288	3319	3347	3378	3408	3439	3469	3500	3531	3561	3592	3622
10	3353	3684	3712	3743	3773	3804	3834	3865	3896	3926	3957	3987
11	4018	4049	4077	4108	4138	4169	4199	4230	4261	4291	4322	4352
12	4383	4414	4443	4474	4504	4535	4565	4596	4627	4657	4688	4718
13	4749	4780	4808	4839	4869	4900	4930	4961	4992	5022	5053	5083
14	5114	5145	5173	5204	5234	5265	5295	5326	5357	5387	5418	5448
15	5479	5510	5538	5569	5599	5630	5660	5691	5722	5752	5783	5813
16	5844	5875	5904	5935	5965	5996	6026	6057	6088	6118	6149	6179
17	6210	6241	6269	6300	6330	6361	6391	6422	6453	6483	6514	6544
18	6575	6606	6634	6665	6695	6726	6756	6787	6818	6848	6879	6909
19	6940	6971	6999	7030	7060	7091	7121	7152	7183	7213	7244	7274

† From 1582 October 15 to 1599 December 31 inclusive, Gregorian calendar, the numbers given by the above tables must be diminished by 10.

* The numbers given for the years 1700, 1800 and 1900 which are not leap years, are for January - 1 and consequently the numbers 0 and 31 for January 0 and February 0 of these years must be increased by 1 and read as 1 and 32 respectively.

N.B. To find the Julian Day Number for a B.C. date, first express the year astronomically, i.e. diminish it by 1 and put a negative sign before it. Then make the number positive by adding the smallest multiple of 1000. The Julian Day Number for the date thus obtained diminished by 365250 for each multiple of 1000 added will give the required Julian Day Number for the B.C. date in question.

The Julian Day is completed at noon. In order to obtain the Julian Day Number for 0^h U.T., diminish the figure obtained from the above tables by 0.5.

The tables give the Day Numbers upto 1582, Oct. 4 for the Julian calendar and from 1582, Oct. 15 onward for the Gregorian calendar.

TABLE – X
ATMOSPHERIC REFRACTION
MEAN REFRACTION FOR TEMPERATURE 25° C AND PRESSURE 1000 mb

Apparent Altitude	Mean Refraction	Apparent Altitude	Mean Refraction	Apparent Altitude	Mean Refraction	Apparent Altitude	Mean Refraction
° ′	′ ″	° ′	′ ″	° ′	′ ″	°	′ ″
-1 00	46 17.5	6 10	7 39.0	17 30	2 49.6	53	0 40.8
0 00	30 59.6	20	7 28.5	18 00	2 44.7	54	39.3
+0 10	29 09.3	30	7 18.5	18 30	2 40.0	55	37.9
20	27 28.9	40	7 08.9	19 00	2 35.6	56	36.5
30	25 57.8	6 50	6 59.7	19 30	2 31.4	57	35.1
0 40	24 34.6	7 00	6 50.8	20 00	2 27.3	58	33.8
0 50	23 18.3	7 10	6 42.3	21 00	2 19.8	59	0 32.6
1 00	22 07.9	20	6 34.1	22 00	2 12.9	60	31.2
10	21 02.6	30	6 26.3	23 00	2 06.6	61	30.0
20	20 02.4	40	6 18.7	24 00	2 00.8	62	28.8
30	19 07.0	7 50	6 11.4	25 00	1 55.4	63	27.6
1 40	18 15.6	8 00	6 04.4	26 00	1 50.4	64	26.4
1 50	17 28.2	8 10	5 57.6	27 00	1 45.7	65	0 25.2
2 00	16 44.0	20	5 51.2	28 00	1 41.3	66	24.1
10	16 02.6	30	5 44.7	29 00	1 37.2	67	23.0
20	15 24.0	40	5 38.6	30 00	1 33.4	68	21.9
30	14 48.0	8 50	5 32.6	31 00	1 29.8	69	20.8
2 40	14 14.4	9 00	5 26.8	32 00	1 26.3	70	19.7
2 50	13 42.9	9 10	5 21.3	33 00	1 23.1	71	0 18.6
3 00	13 13.5	20	5 15.9	34 00	1 20.0	72	17.6
10	12 45.8	30	5 10.6	35 00	1 17.1	73	16.5
20	12 19.6	40	5 05.5	36 00	1 14.3	74	15.5
30	11 55.0	9 50	5 00.6	37 00	1 11.7	75	14.5
3 40	11 31.9	10 00	4 55.9	38 00	1 09.1	76	13.5
3 50	11 10.0	10 30	4 42.4	39 00	1 06.8	77	0 12.5
4 00	10 49.5	11 00	4 30.0	40 00	1 04.4	78	11.5
10	10 30.1	11 30	4 18.7	41 00	1 02.2	79	10.5
20	10 11.7	12 00	4 08.1	42 00	1 00.0	80	09.5
30	9 54.2	12 30	3 58.4	43 00	0 57.9	81	08.6
4 40	9 37.5	13 00	3 49.3	44 00	0 56.0	82	07.6
4 50	9 21.6	13 30	3 40.8	45 00	0 54.1	83	0 06.6
5 00	9 06.5	14 00	3 32.9	46 00	0 52.2	84	05.7
10	8 52.1	14 30	3 25.6	47 00	0 50.4	85	04.7
20	8 38.6	15 00	3 18.6	48 00	0 48.7	86	03.8
30	8 25.5	15 30	3 12.1	49 00	0 47.0	87	02.8
5 40	8 13.0	16 00	3 06.0	50 00	0 45.4	88	01.9
5 50	8 01.2	16 30	3 00.2	51 00	0 43.8	89	0 00.9
6 00	7 49.8	17 00	2 54.8	52 00	0 42.2	90	0 00.0
6 10	7 39.0	17 30	2 49.6	53 00	0 40.8		

Rule: True altitude of a celestial object = Its apparent or observed altitude - refraction.

N.B.-The figures of mean refraction given in the above table are for temperature 25° C and pressure 1000 mb. (750.06 mm. Or 29.530 inches of mercury barometer). For other values of temperature and pressure, corrections form the tables on the following two pages are to be taken and applied to the mean refraction.

TABLE - Xa
ATMOSPHERIC REFRACTION
CORRECTION OF MEAN REFRACTION FOR DIFFERENT VALUES OF TEMPERATURE

Apparent Altitude	- 10° C (14° F)	0° C (32° F)	10° C (50° F)	20° C (68° F)	25° C (77° F)	30° C (86° F)	40° C (104° F)	50° C (122° F)
° ′	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
- 1 00	+ 13 31.7	+ 9 17.8	+ 5 13.4	+ 1 37.7	0 00.0	- 1 32.6	- 4 22.5	- 6 54.8
0 00	7 16.3	5 04.8	2 53.4	0 54.8	0 00.0	0 52.1	2 29.6	3 58.2
+ 0 30	5 39.4	3 57.4	2 15.6	0 42.8	0 00.0	0 41.2	1 58.4	3 09.1
1 00	4 27.7	3 07.8	1 47.8	0 34.7	0 00.0	0 32.1	1 33.8	2 30.7
1 30	3 38.4	2 33.1	1 27.9	0 27.8	0 00.0	0 27.1	1 18.1	2 05.2
2 00	3 00.9	2 07.0	1 13.1	0 23.4	0 00.0	0 22.4	1 05.0	1 44.5
2 30	+ 2 32.9	+ 1 48.1	+ 1 02.1	+ 0 19.6	0 00.0	- 0 19.5	- 0 56.0	- 1 29.9
3 00	2 12.7	1 33.2	0 53.8	0 17.2	0 00.0	0 16.7	0 48.2	1 17.5
3 30	1 56.6	1 21.9	0 47.3	0 15.1	0 00.0	0 14.6	0 42.4	1 08.3
4 00	1 43.2	1 12.5	0 42.0	0 13.5	0 00.0	0 12.9	0 37.6	1 00.6
4 30	1 32.5	1 05.0	0 37.9	0 12.0	0 00.0	0 11.7	0 33.9	0 54.5
5 00	1 23.7	0 58.9	0 35.0	0 10.9	0 00.0	0 10.6	0 30.7	0 49.5
6 00	+ 1 10.2	+ 0 49.4	+ 0 30.0	+ 0 09.1	0 00.0	- 0 09.0	- 0 25.8	- 0 41.5
7 00	1 00.3	0 42.5	0 25.6	0 07.9	0 00.0	0 07.6	0 22.1	0 35.7
8 00	0 52.7	0 37.1	0 21.4	0 06.9	0 00.0	0 06.6	0 19.4	0 31.3
9 00	0 46.8	0 32.9	0 19.1	0 06.1	0 00.0	0 05.9	0 17.2	0 27.8
10 00	0 43.0	0 29.6	0 17.1	0 05.4	0 00.0	0 05.3	0 15.5	0 25.0
11 00	0 39.4	0 26.9	0 15.6	0 05.0	0 00.0	0 04.8	0 14.1	0 22.8
12 00	+ 0 35.7	+ 0 24.3	+ 0 14.2	+ 0 04.6	0 00.0	- 0 04.4	- 0 12.8	- 0 20.7
13 00	0 33.1	0 22.6	0 13.2	0 04.2	0 00.0	0 04.0	0 11.9	0 19.2
14 00	0 30.4	0 21.0	0 12.1	0 03.9	0 00.0	0 03.7	0 11.0	0 17.7
15 00	0 28.4	0 19.6	0 11.3	0 03.6	0 00.0	0 03.5	0 10.2	0 16.5
16 00	0 26.4	0 18.2	0 10.3	0 03.4	0 00.0	0 03.3	0 09.5	0 15.4
17 00	0 24.8	0 17.2	0 09.9	0 03.2	0 00.0	0 03.1	0 08.9	0 14.4
18 00	+ 0 23.3	+ 0 16.2	+ 0 09.3	+ 0 03.0	0 00.0	- 0 02.9	- 0 08.4	- 0 13.5
19 00	0 22.1	0 15.2	0 08.8	0 02.7	0 00.0	0 02.7	0 07.9	0 12.8
20 00	0 20.9	0 14.3	0 08.3	0 02.5	0 00.0	0 02.6	0 07.5	0 12.1
25 00	0 16.3	0 11.2	0 06.5	0 02.1	0 00.0	0 02.0	0 05.9	0 09.4
30 00	0 13.1	0 09.0	0 05.2	0 01.7	0 00.0	0 01.6	0 04.7	0 07.6
35 00	0 10.8	0 07.4	0 04.3	0 01.4	0 00.0	0 01.3	0 03.9	0 06.3
40 00	+ 0 09.0	+ 0 06.2	+ 0 03.6	+ 0 01.2	0 00.0	- 0 01.1	- 0 03.2	- 0 05.2
45 00	0 07.5	0 05.2	0 03.0	0 01.0	0 00.0	0 00.9	0 02.7	0 04.4
50 00	0 06.0	0 04.4	0 02.5	0 00.8	0 00.0	0 00.8	0 02.3	0 03.7
55 00	0 05.3	0 03.6	0 02.1	0 00.7	0 00.0	0 00.7	0 02.0	0 03.1
60 00	0 04.4	0 03.0	0 01.8	0 00.6	0 00.0	0 00.6	0 01.6	0 02.5
65 00	0 03.6	0 02.4	0 01.4	0 00.5	0 00.0	0 00.5	0 01.3	0 02.1
70 00	+ 0 02.8	+ 0 01.9	+ 0 01.1	+ 0 00.4	0 00.0	- 0 00.4	- 0 01.0	- 0 01.6
75 00	0 02.0	0 01.4	0 00.8	0 00.3	0 00.0	0 00.3	0 00.7	0 01.2
80 00	0 01.4	0 00.9	0 00.5	0 00.2	0 00.0	0 00.2	0 00.4	0 00.8
85 00	0 00.7	0 00.4	0 00.2	0 00.1	0 00.0	0 00.1	0 00.2	0 00.4
90 00	+ 0 00.0	+ 0 00.0	+ 0 00.0	+ 0 00.0	0 00.0	- 0 00.0	- 0 00.0	- 0 00.0

TABLE - Xb
ATMOSPHERIC REFRACTION
PRESSURE CORRECTION OF REFRACTION FOR DIFFERENT VALUES OF PRESSURE

PRESSURE			AMOUNT OF REFRACTION CORRECTED FOR PRESSURE												
			1′	2′	3′	5′		10′		20′		30′		60′	
mb	mm	Inch	″	″	″	′	″	′	″	′	″	′	″	′	″
660	495.0	19.49	- 20.4	- 40.8	- 61.3	- 1	42.3	- 3	26.5	- 7	04.9	- 10	59.1	- 24	19
670	502.5	19.79	19.8	39.7	59.5	1	39.3	3	20.4	6	52.5	10	39.8	23	36
680	510.0	20.08	19.2	38.4	57.7	1	36.3	3	14.3	6	39.8	10	20.2	22	53
690	517.5	20.38	18.6	37.2	55.9	1	33.3	3	08.2	6	27.4	10	00.9	22	10
700	525.0	20.67	18.0	36.0	54.1	1	30.3	3	02.2	6	14.9	9	41.5	21	27
710	532.5	20.97	17.4	34.8	52.3	1	27.3	2	56.1	6	02.5	9	22.2	20	45
720	540.0	21.26	- 16.8	- 33.5	- 50.6	- 1	24.3	- 2	50.0	- 5	50.0	- 9	02.8	- 20	01
730	547.5	21.56	16.2	32.4	48.7	1	21.2	2	43.9	5	37.4	8	43.3	19	18
740	555.0	21.85	15.6	31.2	46.9	1	18.2	2	37.8	5	24.9	8	23.9	18	35
750	562.6	22.15	15.0	30.0	45.1	1	15.2	2	31.8	5	12.4	8	04.6	17	53
760	570.1	22.44	14.4	28.9	43.3	1	12.3	2	25.8	5	00.2	7	45.6	17	21
770	577.6	22.74	13.8	27.6	41.5	1	09.2	2	19.7	4	47.5	7	25.9	16	27
780	585.1	23.03	- 13.2	- 26.4	- 39.7	- 1	06.2	- 2	13.6	- 4	35.0	- 7	06.5	- 15	44
790	592.6	23.33	12.6	25.2	37.9	1	03.2	2	07.6	4	22.5	6	47.2	15	01
800	600.1	23.62	12.0	24.0	36.0	1	00.2	2	01.4	4	09.9	6	27.6	14	18
810	607.6	23.92	11.4	22.8	34.3	0	57.2	1	55.4	3	57.5	6	08.3	13	35
820	615.1	24.22	10.8	21.6	32.4	0	54.2	1	49.3	3	44.9	5	48.9	12	52
830	622.6	24.51	10.2	20.4	30.7	0	51.2	1	43.3	3	32.5	5	29.6	12	10
840	630.1	24.81	- 9.6	- 19.2	- 28.9	- 0	48.2	- 1	37.2	- 3	20.0	- 5	10.2	- 11	27
850	637.6	25.10	9.0	18.0	27.0	0	45.1	1	31.1	3	07.4	4	50.7	10	43
860	645.1	25.40	8.4	16.8	25.2	0	42.1	1	25.0	2	54.9	4	31.3	10	01
870	652.6	25.69	7.8	15.6	23.4	0	39.1	1	19.0	2	42.5	4	12.0	9	18
880	660.1	25.99	7.2	14.4	21.6	0	36.1	1	12.9	2	30.0	3	52.6	8	35
890	667.6	26.28	6.6	13.2	19.8	0	33.1	1	06.8	2	17.5	3	33.3	7	52
900	675.1	26.58	- 6.0	- 12.0	- 18.0	- 0	30.1	- 1	00.7	- 2	04.9	- 3	13.7	- 7	09
910	682.6	26.87	5.4	10.8	16.2	0	27.1	0	54.7	1	52.5	2	54.3	6	26
920	690.1	27.17	4.8	9.6	14.4	0	24.1	0	48.6	1	39.9	2	35.0	5	43
930	697.6	27.46	4.2	8.4	12.6	0	21.1	0	42.5	1	27.5	2	15.7	5	01
940	705.1	27.76	3.6	7.2	10.8	0	18.1	0	36.4	1	15.0	1	50.3	4	17
950	712.6	28.05	3.0	6.0	9.0	0	15.0	0	30.3	1	02.4	1	36.9	3	34
960	720.1	28.35	- 2.4	- 4.8	- 7.2	- 0	12.0	- 0	24.3	- 0	49.9	- 1	17.4	- 2	51
970	727.6	28.64	1.8	3.6	5.4	0	09.0	0	18.2	0	37.5	0	58.2	2	09
980	735.1	28.94	1.2	2.4	3.6	0	06.0	0	12.1	0	25.0	0	38.7	1	26
990	742.6	29.24	- 0.6	- 1.2	- 1.8	- 0	03.0	- 0	06.1	- 0	12.5	- 0	19.4	- 0	43
1000	750.1	29.53	0.0	0.0	0.0	0	00.0	0	00.0	0	00.0	0	00.0	0	00
1010	757.6	29.83	+ 0.6	+ 1.2	+ 1.8	+ 0	03.1	+ 0	06.1	+ 0	12.5	+ 0	19.5	+ 0	43
1020	765.1	30.12	1.2	2.4	3.6	0	06.0	0	12.2	0	25.1	0	38.9	1	26
1030	772.6	30.42	1.8	3.6	5.4	0	09.0	0	18.2	0	37.5	0	58.2	2	09
1040	780.1	30.71	2.4	4.8	7.2	0	12.0	0	24.3	0	50.0	0	77.6	2	52
1050	787.6	31.01	+ 3.0	+ 6.0	+ 9.0	+ 0	15.0	+ 0	30.3	+ 0	62.4	+ 0	96.9	+ 3	24

TABLE - XI
FACTORS FOR COMPUTING THE GEOCENTRIC COORDINATES OF A PLACE

ϕ	*S*	*C*	ϕ	*S*	*C*
°			°		
0	0.993306	1.000000	45	0.994972	1.001678
1	0.993307	1.000001	46	0.995031	1.001737
2	0.993310	1.000004	47	0.995089	1.001795
3	0.993315	1.000009	48	0.995147	1.001854
4	0.993322	1.000016	49	0.995205	1.001912
5	0.993331	1.000025	50	0.995262	1.001970
6	0.993342	1.000037	51	0.995320	1.002028
7	0.993355	1.000050	52	0.995377	1.002085
8	0.993370	1.000065	53	0.995433	1.002142
9	0.993387	1.000082	54	0.995489	1.002198
10	0.993406	1.000101	55	0.995544	1.002254
11	0.993427	1.000122	56	0.995599	1.002309
12	0.993449	1.000145	57	0.995652	1.002363
13	0.993474	1.000169	58	0.995705	1.002416
14	0.993500	1.000196	59	0.995758	1.002468
15	0.993528	1.000224	60	0.995809	1.002520
16	0.993558	1.000254	61	0.995859	1.002570
17	0.993590	1.000286	62	0.995908	1.002620
18	0.993623	1.000320	63	0.995956	1.002668
19	0.993658	1.000355	64	0.996002	1.002715
20	0.993695	1.000392	65	0.996048	1.002761
21	0.993733	1.000430	66	0.996092	1.002805
22	0.993773	1.000470	67	0.996135	1.002848
23	0.993814	1.000511	68	0.996176	1.002890
24	0.993856	1.000554	69	0.996216	1.002930
25	0.993900	1.000598	70	0.996255	1.002969
26	0.993945	1.000644	71	0.996291	1.003006
27	0.993992	1.000691	72	0.996327	1.003041
28	0.994039	1.000739	73	0.996360	1.003075
29	0.994088	1.000788	74	0.996392	1.003107
30	0.994138	1.000838	75	0.996422	1.003138
31	0.994189	1.000889	76	0.996451	1.003166
32	0.994241	1.000941	77	0.996477	1.003193
33	0.994293	1.000994	78	0.996502	1.003218
34	0.994347	1.001048	79	0.996525	1.003241
35	0.994401	1.001103	80	0.996546	1.003262
36	0.994456	1.001158	81	0.996565	1.003281
37	0.994512	1.001214	82	0.996582	1.003299
38	0.994568	1.001271	83	0.996597	1.003314
39	0.994625	1.001328	84	0.996610	1.003327
40	0.994682	1.001386	85	0.996622	1.003338
41	0.994740	1.001444	86	0.996631	1.003348
42	0.994798	1.001502	87	0.996638	1.003355
43	0.994856	1.001560	88	0.996643	1.003360
44	0.994914	1.001619	89	0.996646	1.003363
45	0.994972	1.001678	90	0.996647	1.003364

$\rho \sin \phi' = (S+H) \sin \phi$ $\qquad$ $\rho \cos \phi' = (C+H) \cos \phi$

$H = 0.156779 \times \text{elevation in meters} \times 10^{-6}$ $\qquad$ $H = 0.047786 \times \text{elevation in feet} \times 10^{-6}$

TABLE - XII
CONVERSION OF GEOGRAPHIC TO GEOCENTRIC COORDINATES

φ	φ′ - φ	ρ	ONE DEGREE OF Latitude	ONE DEGREE OF Longitude	φ	φ′ - φ	ρ	ONE DEGREE OF Latitude	ONE DEGREE OF Longitude
°	′ ″		Kilometers	Kilometers	°	′ ″		Kilometers	Kilometers
0	0 00.0	1.000000	110.57	111.32	45	- 11 32.7	0.998331	111.13	78.85
1	- 0 24.1	0.999999	110.58	111.30	46	11 32.4	0.998272	111.15	77.46
2	0 48.2	0.999996	110.58	111.25	47	11 31.2	0.998214	111.17	76.06
3	1 12.2	0.999991	110.58	111.17	48	11 29.2	0.998155	111.19	74.63
4	1 36.1	0.999984	110.58	111.05	49	11 26.3	0.998097	111.21	73.17
5	1 59.9	0.999975	110.58	110.90	50	11 22.6	0.998039	111.23	71.70
6	2 23.6	0.999964	110.59	110.71	51	11 18.1	0.997982	111.25	70.20
7	2 47.0	0.999951	110.59	110.50	52	11 12.7	0.997925	111.27	68.68
8	3 10.3	0.999936	110.60	110.24	53	11 06.5	0.997868	111.29	67.14
9	3 33.4	0.999919	110.60	109.96	54	10 59.5	0.997812	111.31	65.58
10	- 3 56.2	0.999900	110.61	109.64	55	- 10 51.7	0.997756	111.32	63.99
11	4 18.7	0.999879	110.62	109.29	56	10 43.1	0.997702	111.34	62.39
12	4 40.9	0.999856	110.62	108.90	57	10 33.7	0.997648	111.36	60.77
13	5 02.8	0.999832	110.63	108.49	58	10 23.5	0.997594	111.38	59.13
14	5 24.3	0.999805	110.64	108.03	59	10 12.6	0.997542	111.40	57.48
15	5 45.4	0.999777	110.65	107.55	60	10 00.9	0.997491	111.41	55.80
16	6 06.0	0.999747	110.66	107.03	61	9 48.5	0.997440	111.43	54.11
17	6 26.3	0.999716	110.67	106.49	62	9 35.4	0.997391	111.45	52.40
18	6 46.1	0.999682	110.68	105.91	63	9 21.5	0.997343	111.46	50.67
19	7 05.4	0.999647	110.69	105.29	64	9 07.0	0.997296	111.48	48.93
20	- 7 24.1	0.999611	110.70	104.65	65	- 8 51.8	0.997250	111.49	47.18
21	7 42.4	0.999573	110.72	103.97	66	8 36.0	0.997206	111.51	45.40
22	8 00.0	0.999533	110.73	103.26	67	8 19.5	0.997163	111.52	43.62
23	8 17.1	0.999492	110.74	102.52	68	8 02.4	0.997121	111.54	41.82
24	8 33.6	0.999449	110.76	101.75	69	7 44.7	0.997081	111.55	40.01
25	8 49.5	0.999405	110.77	100.95	70	7 26.4	0.997042	111.56	38.19
26	9 04.7	0.999360	110.79	100.12	71	7 07.6	0.997005	111.57	36.35
27	9 19.3	0.999314	110.80	99.26	72	6 48.3	0.996970	111.59	34.50
28	9 33.2	0.999266	110.82	98.36	73	6 28.4	0.996936	111.60	32.65
29	9 46.4	0.999217	110.84	97.44	74	6 08.1	0.996904	111.61	30.78
30	- 9 58.9	0.999167	110.85	96.49	75	- 5 47.4	0.996874	111.61	28.90
31	10 10.7	0.999116	110.87	95.50	76	5 26.2	0.996845	111.62	27.02
32	10 21.7	0.999064	110.89	94.49	77	5 04.6	0.996818	111.63	25.12
33	10 32.0	0.999011	110.90	93.45	78	4 42.6	0.996793	111.64	23.22
34	10 41.5	0.998958	110.92	92.39	79	4 20.3	0.996770	111.65	21.31
35	10 50.2	0.998903	110.94	91.29	80	3 57.7	0.996749	111.66	19.39
36	10 58.1	0.998848	110.96	90 16	81	3 34.7	0.996730	111.67	17.47
37	11 05.3	0.998792	110.98	89.01	82	3 11.6	0.996713	111.67	15.54
38	11 11.6	0.998736	111.00	87.83	83	2 48.1	0.996697	111.68	13.61
39	11 17.1	0.998679	111.02	86.63	84	2 24.5	0.996684	111.68	11.67
40	-11 21.8	0.998622	111.03	85.39	85	- 2 00.7	0.996673	111.69	9.73
41	11 25.7	0.998564	111.05	84.14	86	1 36.7	0.996664	111.69	7.79
42	11 28.7	0.998506	111.07	82.85	87	1 12.7	0.996656	111.69	5.85
43	11 30.9	0.998447	111.09	81.54	88	0 48.5	0.996651	111.69	3.90
44	11 32.2	0.998389	111.11	80.21	89	- 0 24.3	0.996648	111.69	1.95
45	-11 32.7	0.998331	111.13	78.85	90	0 00.0	0.996647	111.69	0.00

φ and φ′ are the geographic and geocentric latitude respectively
ρ = radius of the earth.
1 kilometre = 0.621372 miles.

LATITUDE AND LONGITUDE OF PLACES

Place	Altitude (Metre)	Latitude	Longitude In arc	Longitude In time	Reduction of Greenwich Sid. Time	Reduction of L.M.T. to Indian Standard Time	ρ sin φ′	ρ cos φ′
		° ′	° ′	h m s	s	m s		
Agartala	16	+23 31.8	+ 91 09.0	+6 04 36	+59.89	-34 36	+0.39677	0.91734
Agra	160	+27 05.6	+ 77 34.8	+5 10 19	+50.98	+19 51	+0.45272	0.89091
Ahmedabad	49	+23 03.0	+ 72 40.2	+4 50 41	+47.75	+39 19	+0.38912	0.92064
Aizawl	1097	+23 26.4	+ 92 43.2	+6 10 53	+60.93	-40 53	+0.39540	0.91812
Ajmer	486	+26 16.2	+ 74 22.2	+4 57 29	+48.87	+32 31	+0.43996	0.89738
Alibag (Obs.) Mumbai,	7	+19 00.0	+ 72 30.6	+4 50 02	+47.65	+39 58	+0.33350	0.94586
Aligarh	187	+27 31.8	+ 78 2.44	+5 12 10	+51.28	+17 47	+0.45946	0.88743
Allahabad	96	+25 16.2	+ 81 26.4	+5 25 46	+53.51	+04 14	+0.42429	0.90487
Amritsar	231	+31 22.8	+ 74 31.2	+4 58 05	+48.97	+31 55	+0.51771	0.85454
Bangalore	921	+12 34.8	+ 77 21.0	+5 09 24	+50.83	+20 36	+0.21641	0.97629
Bangkok, Thailand	16	+13 25.0	+100 18.0	+6 41 12	+65.91	- 71 12	+0.23052	0.97289
Baroda	35	+22 12.0	+ 73 9.6	+4 52 38	+48.07	+37 22	+0.37549	0.92632
Bhopal	506	+23 10.2	+ 77 12.6	+5 08 50	+50.73	+21 10	+0.39106	0.91989
Bhuj	105	+23 09.0	+ 69 24.0	+4 37 36	+45.60	+52 24	+0.39072	0.91997
Bhubaneswar	46	+20 00.0	+ 85 30.0	+5 42 00	+56.18	- 12 00	+0.33987	0.94007
Bikaner	224	+28 01.0	+ 73 10.8	+4 52 43	+48.09	+37 17	+0.46695	0.88349
Bilaspur,(H.P)	502	+31 11.4	+ 76 30.0	+5 06 00	+50.27	+24 00	+0.51491	0.85629
Buenos Aires (Naval Obs.), Argentina	6	-34 21.0	- 58 12.0	- 3 52 48	-38.24	.. ..	-0.56107	0.82649
Cairo	68	+30 01.0	+ 31 09.0	+2 04 36	+20.47	.. ..	+0.49733	0.86662
Canberra (Mount Stromlo), Australia	767	-35 10.2	+149 10.5	+9 56 42	+98.02	.. ..	-0.57285	0.81845
Cape Town (Ast. Obs.), S. Africa	18	-33 33.6	+ 18 15.0	+1 13 00	+11.99	.. ..	-0.54967	0.83416
Chandigarh	347	+30 25.2	+ 76 32.0	+5 06 08	+50.29	+23 52	+0.50340	0.86312
Chennai (or Madras) Obs.	7	+13 00.0	+ 80 06.6	+5 20 26	+52.64	+ 9 34	+0.22348	0.97454
Chittagong, Bangladesh	27	+22 12.6	+ 91 31.8	+6 06 07	+60.14	- 36 07	+0.37565	0.92625
Colaba Obs. Mumbai, (Bombay)	14	+19 04.2	+ 72 31.0	+4 50 04	+47.65	+39 56	+0.32465	0.94546
Colombo (Obs.), Srilanka	6	+ 6 33.6	+ 79 33.6	+5 18 14	+52.28	+11 46	+011348	0.99350
Cuttack	26	+20 16.8	+ 85 33.6	+5 42 14	+56.42	- 12 14	+0.34443	0.93839
Dacca,Bangladesh	7	+23 25.8	+ 90 15.6	+6 01 02	+59.31	- 31 02	+0.39518	0.91803
Darjeeling	2128	+27 02.0	+ 88 10.8	+5 52 43	+57.94	- 22 43	+0.45193	0.89166
Dehra Dun	682	+30 11.3	+ 78 01.2	+5 12 05	+51.27	+17 55	+0.49995	0.86520
Delhi	220	+28 21.0	+ 77 07.2	+5 08 29	+50.68	+21 31	+0.47205	0.88076
Dibrugarh	106	+27 17.4	+ 94 06.0	+6 16 24	+61.83	- 46 24	+0.45575	0.88734
Gangtok	1768	+27 12.0	+ 88 22.2	+5 53 29	+58.07	- 23 29	+0.45448	0.89029
Guwahati	55	+26 3.6.0	+ 91 21.0	+6 05 24	+60.03	- 35 24	+0.43666	0.89892
Gauribidanur (Radio Astr. Obs.)	686	+13 36.2	+ 77 26.1	+5 09 44	+50.88	+20 16	+0.23369	0.97223
Gaya	111	+24 27.0	+ 84 34.2	+5 38 17	+55.57	- 8 17	+0.41137	0.91086

1 metre = 3.2808 feet

LATITUDE AND LONGITUDE OF PLACES

Place	Altitude (Metre)	Latitude	Longitude In arc	Longitude In time	Reduction of Greenwich Sid. Time	Reduction of L.M.T. to Indian Standard Time	ρ sin φ′	ρ cos φ′
		° ′	° ′	h m s	s	m s		
Geneva (Obs.), Switzerland	465	+46 07.8	+ 6 04.2	+0 24 17	+ 3.99	.. ..	+0.71739	0.69428
Greenwich (Royal Obs.).	47	+51 28.6	0 00	0 00 00.0	0.00	.. ..	+0.77872	0.62412
Hanle/ Mt.Saraswati (Indian Ast. Obs.)	4467	+32 46.8	+ 78 57.9	+5 15 51.6	+51.89	+14 8.4	+0.53870	0.84217
Haridwar	274	+29 34.8	+ 78 08.0	+5 12 32.0	+51.34	+ 17 28	+0.49076	0.87041
Heidelberg Obs., Germany	570	+49 14.0	+ 8 25.2	+0 33 41.0	+ 5.53	.. ..	+0.75382	0.65430
Helwan (Obs.), Egypt	116	+29 51.5	+ 31 22.8	+2 05 31.2	+20.62	.. ..	+0.49494	0.86800
Herstmonceux (Royal Obs.), Sussex, U.K.	31	+50 52.0	+ 0 20.3	+0 01 21.0	+ 0.22	.. ..	+0.77205	0.63241
Hyderabad (Nizamiah Obs.)	554	+17 25.9	+ 78 27.2	+5 13 49.0	+51.55	+ 16 11	+0.29768	0.95444
Imphal	801	+24 26.4	+ 93 34.8	+6 14 19.0	+61.49	- 44 19	+0.41126	0.91103
India, Central Station of	-	+23 11.0	+ 82 30.0	+5 30 00.0	+54.21	0 00	+0.39124	0.91973
Indore	556	+22 26.4	+ 75 30.0	+5 02 00.0	+49.61	+ 28 00	+0.37938	0.92481
Istambul (Univ. Obs.), Turkey	65	+41 00.7	+ 28 57.9	+1 55 51.6	+19.03	.. ..	+0.65277	0.75567
IUCAA Giravali Obs., Pune	1000	+18 19.2	+ 73 30.6	+4 54 02.0	+48.3	+35 58	+0.31237	0.94978
Jabalpur	393	+23 07.2	+ 79 34.2	+5 18 17.0	+52.29	+ 11 43	+0.39026	0.92022
Jaipur	436	+26 33.0	+ 75 31.2	+5 02 05.0	+49.62	+ 27 55	+0.44431	0.89520
Jakarta, Indonesia	23	- 6 07.2	+106 30.0	+7 06 00.0	+69.98	.. ..	-0.10590	0.99434
Jamshedpur	152	+22 29.4	+ 86 06.6	+5 44 26.0	+56.58	- 14 26	+0.38016	0.92442
Japal Rangapur (Obs.),	695	+17 05.9	+ 78 43.7	+5 14 55.0	+51.73	+ 15 05	+0.29216	0.95618
Jodhpur	224	+26 10.8	+ 73 00.6	+4 52 02.0	+47.97	+ 37 58	+0.43854	0.89803
Johannesberg, South Africa	1806	- 26 10.9	+ 28 04.5	+1 52 18.0	+18.45	.. ..	-0.43868	0.89824
Kabul, Afghanistan	1766	+34 18.0	+ 69 10.8	+4 36 43.0	+45.46	+ 53 17	+0.56051	0.82721
Kanchipuram	76	+12 30.0	+ 79 27.0	+5 17 48.0	+52.21	+ 12 12	+0.21503	0.97646
Kanpur	126	+26 15.6	+ 80 13.2	+5 20 53.0	+52.71	+ 9 07	+0.43978	0.89740
Karachi, Pakistan	4	+24 53.6	+ 67 02.4	+4 28 10.0	+44.05	+ 61 50	+0.41836	0.90763
Kathmandu, Nepal	1324	+27 23.2	+ 85 07.2	+5 40 29.0	+55.93	- 10 29	+0.45733	0.88874
Kavalur (Vainu Bappu Obs.),	725	+12 34.6	+ 78 49.6	+5 15 18.0	+51.80	+ 14 42	+0.21635	0.97627
Kodaikanal (Solar Obs.)	2343	+10 13.8	+ 77 28.1	+5 09 52.0	+50.90	+ 20 08	+0.17649	0.98457
Kohima	1405	+25 24.0	+ 94 04.8	+6 16 19.0	+61.82	- 46 19	+0.42642	0.90409
Kolkata (Alipore Obs.), (Calcutta)	6	+22 19.2	+ 88 12.0	+5 52 48.0	+57.96	- 22 48	+0.37742	0.92553
Kolkata (Presi. Coll. Obs.)	12	+22 23.4	+ 88 16.2	+5 53 05.0	+58.00	- 23 05	+0.37854	0.92506
Kurnool	281	+15 30.0	+ 78 03.0	+5 12 12.0	+51.29	+ 17 48	+0.26552	0.96390

1 metre = 3.2808 feet

LATITUDE AND LONGITUDE OF PLACES

Place	Altitude (Metre)	Latitude	Longitude In arc	Longitude In time	Reduction of Greenwich Sid. Time	Reduction of L.M.T. to Indian Standard Time	ρ sin φ′	ρ cos φ′
		° ′	° ′	h m s	s	m s		
Kyoto (Univ. Ast. Dept. Obs.), Japan	86	+35 00.6	+135 20.4	+9 1 22.0	+88.93	.. ..	+0.57052	0.81997
Lahore, Pakistan	214	+31 22.2	+ 74 15.6	+4 57 02.0	+48.80	+ 32 58	+0.51756	0.85269
Lucknow	113	+26 31.2	+ 80 33.6	+5 22 14.0	+52.94	+ 7 46	+0.44383	0.89539
Maitri (Indian base station at Antarctica)	132	-70 46.0	+ 11 45.0	+0 47 00.0	+ 7.72	.. ..	-0.94069	0.33041
Mangalore	22	+12 33.0	+ 74 31.8	+4 58 07.0	+48.97	+ 31 53	+0.21587	0.97626
Moscow (Sternberg State Ast. Inst.), Russia	195	+55 27.0	+ 37 22.2	+2 29 29.0	+24.56	.. ..	+0.82001	0.56843
Mount Abu (Gurushikhar Obs.)	1700	+24 23.4	+ 72 25.8	+4 49 43.0	+47.59	+40 17	+0.41053	0.91152
Mount Palomar (Obs.), U.S.A.	1706	+33 21.4	-116 51.8	- 7 47 27.2	-76.79	.. ..	+054687	0.83633
Mount Wilson (Obs.), U.S.A.	1742	+34 13.0	-118 03.6	- 7 52 14.4	-77.58	.. ..	+0.55931	0.82802
Mysore	767	+12 10.8	+ 76 25.2	+5 05 41.0	+50.22	+ 24 19	+0.20963	0.97775
Nagpur	312	+21 05.4	+ 79 04.2	+5 16 17.0	+51.96	+ 13 43	+0.35760	0.93347
Nainital (Aryabhatta Res. Inst. Of Obs. Sci.)	1927	+29 13.8	+ 79 18.0	+5 17 12.0	+52.11	+ 12 48	+0. 48558	0.87363
New York (Rutherford Obs.), U.S.A.	25	+40 25.8	- 74 00.6	- 4 56 02.0	-48.63	.. ..	+0.64509	0.76228
Ottawa, Canada	87	+45 16.2	- 75 22.2	- 5 01 29.0	-49.53	.. ..	+0.70688	0.70497
Panaji	56	+15 18.0	+ 73 33.0	+4 54 12.0	+48.33	+ 35 48	+0.26217	0.96479
Paris (Obs.), France	67	+48 30.0	+ 2 12.0	+0 08 49.0	+ 1.45	.. ..	+0.74535	0.66387
Patiala	251	+30 12.0	+ 76 15.0	+5 05 00.0	+50.10	+ 25 00	+0.50010	0.86504
Patna	53	+25 21.6	+ 85 03.6	+5 40 14.0	+55.89	- 10 14	+0.42570	0.90420
Peshawar, Pakistan	358	+34 01.0	+ 71 34.0	+4 46 15.0	+47.03	+ 43 45	+0.55630	0.82979
Pondicherry	6	+11 34.8	+ 79 29.4	+5 17 58.0	+52.23	+ 12 02	+0. 19942	0.97978
Pune	559	+18 19.0	+ 73 30.0	+4 54 00.0	+48 .30	+ 36 00	+0.31230	0.94973
Porbandar	7	+21 22.2	+ 69 29.4	+4 37 58.0	+45.66	+ 52 02	+0.36211	0.93166
Port Blair	79	+11 24.0	+ 92 25.8	+6 09 43.0	+60.74	- 39 43	+0.19636	0.98041
Puri	6	+19 28.8	+ 85 29.4	+5 41 58.0	+56.18	- 11 58	+0.33137	0.94311
Quetta, Pakistan	1673	+30 07.2	+ 67 00.0	+4 28 00.0	+44.03	+ 62 00	+0.49901	0.86593
Rajkot	132	+22 10.8	+ 70 33.6	+4 42 14.0	+46 .36	+ 47 46	+0.37518	0.92646
Rawalpindi, Pakistan	510	+33 22.2	+ 73 03.6	+4 52 14.0	+48.01	+ 37 46	+0.54696	0.83605
Rome (Obs.), Italy	152	+41 33.0	+ 12 16.8	+0 49 07.2	+ 8.07	.. ..	+0.65982	0.74950
San Fernando (Naval Obs.), Spain	27	+36 28.0	- 6 12.2	-0 24 48.8	- 4.08	.. ..	+0.59108	0.80516
Shillong	1500	+25 20.4	+ 91 33.6	+6 06 14.0	+61.16	- 36 14	+0.42549	0.90455

1 metre = 3.2808 feet

LATITUDE AND LONGITUDE OF PLACES

Place	Altitude (Metre)	Latitude	Longitude In arc	Longitude In time	Reduction of Greenwich Sid. Time	Reduction of L.M.T. to Indian Standard Time	ρ sin φ′	ρ cos φ′
		° ′	° ′	h m s	s	m s		
Sholapur	476	+17 24.0	+ 75 33.6	+5 02 14	+49.65	+ 27 46	+0.29715	0.95460
Siliguri	127	+26 24.0	+ 88 13.2	+5 52 53	+57.97	- 22 53	+0.44196	0.89632
Simla	2202	+31 03.6	+ 77 07.8	+5 08 31	+50. 68	+ 21 29	+0.51312	0.85769
Singapore	18	+ 1 10.2	+103 30.6	+6 54 02	+68.02	.. ..	+0.02028	0.99980
Srinagar	1586	+34 03.6	+ 74 30.6	+4 58 02	+48.96	+ 31 58	+0.55704	0.82953
St. Petersburg Univ. Obs., Russia	3	+59 56.5	+ 30 17.7	+2 01 11	+19.91	.. ..	+0.86189	0.50214
Tehran, Iran	1200	+35 24.6	+ 51 15.0	+3 25 00	+33.68	.. ..	+0.57630	0.81610
Tokyo (Hydrographic Obs.), Japan	41	+35 24.0	+138 27.0	+9 13 48	+90.98	.. ..	+0.57605	0.81605
Thiruvanantapuram	61	+ 8 17.4	+ 76 34.2	+5 06 17	+50.31	+ 23 43	+0.14323	0.98963
Udaipur (Solar Obs.)	301	+24 21.0	+ 73 25.2	+4 53 41	+48.24	+ 36 19	+0.40980	0.91161
Udhagamandalam (Ooty) (Rad. Astr.Centre)	2150	+11 22.9	+ 76 40.0	+5 06 40	+50.38	+ 23 20	+0.19611	0.98079
Ujjain	496	+23 06.3	+ 75 28.2	+5 01 53	+49.59	+ 28 07	+0.39002	0.92033
Varanasi	76	+25 10.8	+ 83 00.0	+5 32 00	+54.54	- 2 00	+0.42288	0.90554
Visakhapatnam	38	+17 25.8	+ 83 08.4	+5 32 34	+54.63	- 2 34	+0.29763	0.95438
Washington (U. S. Naval Obs.), U.S.A.	92	+38 33.0	- 77 02.4	- 5 08 10	-50.62	.. ..	+0.61984	0.78309
Yangon, Myanmar	28	+16 27.0	+ 96 7.20	+6 24 29	+63.16	- 54 29	+0.28136	0.95933

1 metre = 3.2808 feet

SEMI-DIURNAL AND SEMI-NOCTURNAL ARCS

(FOR TRUE ALTITUDE = 0)

Lat. / Decli.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
° '	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
0 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00	6 00
5 00	6 00	6 04	6 07	6 12	6 14	6 17	6 20	6 24	6 26	6 28	6 30	6 32	6 35
10 00	6 00	6 07	6 15	6 23	6 28	6 34	6 41	6 49	6 52	6 56	7 01	7 06	7 11
15 00	6 00	6 11	6 22	6 36	6 43	6 52	7 02	7 14	7 20	7 27	7 34	7 42	7 51
20 00	6 00	6 15	6 30	6 49	6 59	7 11	7 25	7 43	7 51	8 00	8 11	8 22	8 36
23 00	6 00	6 18	6 36	6 58	7 11	7 25	7 43	8 05	8 15	8 27	8 40	8 56	9 15
25 00	6 00	6 19	6 39	7 02	7 16	7 32	7 51	8 15	8 27	8 40	8 55	9 13	9 35
28 00	6 00	6 22	6 45	7 12	7 27	7 46	8 08	8 37	8 52	9 08	9 28	9 59	10 28
30 00	6 00	6 23	6 49	7 18	7 35	7 56	8 21	8 54	9 11	9 30	9 55	10 30	12 00

When the latitude of the place and the declination of the heavenly body are of the same sign then the figure represent semi-diurnal arc, when of opposite signs then semi-nocturnal arc.

AMPLITUDE OF RISING AND SETTING

(FOR TRUE ALTITUDE = 0)

Lat. / Decli.	0º	10º	20º	30º	35º	40º	45º	50º	52º	54º	56º	58º	60º
° '	° '	° '	° '	° '	° '	° '	° '	° '	° '	° '	° '	° '	° '
0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
5 00	5 00	5 05	5 19	5 47	6 06	6 32	7 05	7 48	8 08	8 32	8 58	9 28	10 02
10 00	10 00	10 09	10 39	11 34	12 14	13 06	14 13	15 40	16 23	17 11	18 05	19 08	20 19
15 00	15 00	15 14	15 59	17 23	18 25	19 45	21 28	23 45	24 52	26 07	27 34	29 14	31 10
20 00	20 00	20 19	21 21	23 16	24 41	26 31	28 56	32 09	33 45	35 35	37 42	40 12	43 10
23 00	23 00	23 50	25 03	27 21	29 04	31 18	34 15	38 15	40 16	42 37	45 22	48 40	52 44
25 00	25 00	25 25	26 44	29 13	31 04	33 29	36 42	41 06	43 21	45 58	49 06	52 54	57 42
28 00	28 00	28 28	29 58	32 50	34 58	37 48	41 36	46 55	49 41	53 00	57 06	62 22	69 52
30 00	30 00	30 31	32 09	35 16	37 37	40 45	45 00	51 04	54 18	58 17	63 24	70 39	90 00

The amplitude of rising and setting points of a heavenly body is measured from the East or the West point of the horizon towards the northern or southern direction as the case may be. The amplitude is of the same sign as that of declination of the body.

Note - If true zenith distance of the heavenly body at the time of rising or setting be 90º + *h*, then the figures of the above two tables would require some correction according to the value of *h* (vide Explanation).

AUGMENTATION OF MOON'S SEMI-DIAMETER

Moon 's Apparent Altitude

Semi-diameter	0º	6º	12º	18º	24º	30º	36º	42º	48º	54º	60º	66º	72º	78º	84º	90º
′ ″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″
14 30	0.1	1.5	2.9	4.3	5.6	6.9	8.1	9.2	10.2	11.1	11.8	12.5	13.0	13.4	13.6	13.7
15 00	0.1	1.6	3.1	4.6	6.0	7.3	8.6	9.8	10.9	11.8	12.7	13.4	13.9	14.3	14.6	14.6
15 30	0.1	1.7	3.3	4.9	6.4	7.9	9.2	10.5	11.6	12.7	13.5	14.3	14.9	15.3	15.6	15.6
16 00	0.1	1.9	3.6	5.2	6.8	8.4	9.8	11.2	12.4	13.5	14.4	15.2	15.9	16.3	16.6	16.7
16 30	0.2	2.0	3.8	5.6	7.3	8.9	10.5	11.9	13.2	14.4	15.4	16.2	16.9	17.4	17.6	17.7
17 00	0.2	2.1	4.0	5.9	7.7	9.5	11.1	12.6	14.0	15.3	16.3	17.2	17.9	18.4	18.7	18.8

The visible or apparent semi-diameter of the moon is augmented over the tabulated value due to moon's altitude above the horizon.

NATURAL TRIGONOMETRIC FUNCTIONS

ANGLE		Sin	Cos	Tan	Cot	Sec	Cosec		
Arc	Time								
°	h m							h m	°
0	0 00	0.00000	1.00000	0.00000	Infinity	1.00000	Infinity	6 00	90
1	0 04	.01745	0.99985	.01746	57.28996	.00015	57.29869	5 56	89
2	0 08	.03490	.99939	.03492	28.63625	.00061	28.65371	5 52	88
3	0 12	.05234	.99863	.05241	19.08114	.00137	19.10732	5 48	87
4	0 16	.06976	.99756	.06993	14.30067	.00244	14.33559	5 44	86
5	0 20	.08716	.99619	.08749	11.43005	.00382	11.47371	5 40	85
6	0 24	.10453	.99452	.10510	9.51436	.00551	9.56667	5 36	84
7	0 28	.12187	.99255	.12278	8.14435	.00751	8.20551	5 32	83
8	0 32	.13917	.99027	.14054	7.11537	.00983	7.18530	5 28	82
9	0 36	.15643	.98769	.15838	6.31375	.01247	6.39245	5 24	81
10	0 40	.17365	.98481	.17633	5.67128	.01543	5.75877	5 20	80
11	0 44	0.19081	0.98163	0.19438	5.14455	1.01872	5.24084	5 16	79
12	0 48	.20791	.97815	.21256	4.70463	.02234	4.80973	5 12	78
13	0 52	.22495	.97437	.23087	4.33148	.02630	4.44541	5 08	77
14	0 56	.24192	.97030	.24933	4.01078	.03061	4.13357	5 04	76
15	1 00	.25882	.96593	.26795	3.73205	.03528	3.86370	5 00	75
16	1 04	.27564	.96126	.28675	3.48741	.04030	3.62796	4 56	74
17	1 08	.29237	.95630	.30573	3.27085	.04569	3.42030	4 52	73
18	1 12	.30902	.95106	.32492	3.07768	.05146	3.23607	4 48	72
19	1 16	.32557	.94552	.34433	2.90421	.05762	3.07155	4 44	71
20	1 20	.34202	.93969	.36397	2.74748	.06418	2.92380	4 40	70
21	1 24	0.35837	0.93358	0.38386	2.60509	1.07115	2.79043	4 36	69
22	1 28	.37461	.92718	.40403	2.47509	.07853	2.66947	4 32	68
23	1 32	.39073	.92050	.42447	2.35585	.08636	2.55930	4 28	67
24	1 36	.40674	.91355	.44523	2.24604	.09464	2.45859	4 24	66
25	1 40	.42262	.90631	.46631	2.14451	.10338	2.36620	4 20	65
26	1 44	.43837	.89879	.48773	2.05030	.11260	2.28117	4 16	64
27	1 48	.45399	.89101	.50953	1.96261	.12233	2.20269	4 12	63
28	1 52	.46947	.88295	.53171	1.88073	.13257	2.13005	4 08	62
29	1 56	.48481	.87462	.55431	1.80405	.14335	2.06267	4 04	61
30	2 00	.50000	.86603	.57735	1.73205	.15470	2.00000	4 00	60
31	2 04	0.51504	0.85717	0.60086	1.66428	1.16663	1.94160	3 56	59
32	2 08	.52992	.84805	.62487	1.60033	.17918	1.88708	3 52	58
33	2 12	.54464	.83867	.64941	1.53987	.19236	1.83608	3 48	57
34	2 16	.55919	.82904	.67451	1.48256	.20622	1.78829	3 44	56
35	2 20	.57358	.81915	.70021	1.42815	.22077	1.74345	3 40	55
36	2 24	.58779	.80902	.72654	1.37638	.23607	1.70130	3 36	54
37	2 28	.60182	.79864	.75355	1.32704	.25214	1.66164	3 32	53
38	2 32	.61566	.78801	.78129	1.27994	.26902	1.62427	3 28	52
39	2 36	.62932	.77715	.80978	1.23490	.28676	1.58902	3 24	51
40	2 40	.64279	.76604	.83910	1.19175	.30541	1.55572	3 20	50
41	2 44	0.65606	0.75471	0.86929	1.15037	1.32501	1.52425	3 16	49
42	2 48	.66913	.74314	.90040	1.11061	.34563	1.49448	3 12	48
43	2 52	.68200	.73135	.93252	1.07237	.36733	1.46628	3 08	47
44	2 56	.69446	.71934	0.96569	1.03553	.39016	1.43956	3 04	46
45	3 00	0.70711	0.70711	1.00000	1.00000	1.41421	1.41421	3 00	45
		Cos	Sin	Cot	Tan	Cosec	Sec	Time	Arc
								ANGLE	

STANDARD TIMES

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF (+) OR BEHIND (-) U.T. OR G.M.T

Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.	
	h	h	m
Aden	+ 3	15	00
Afghanistan	+ 4 1/2	16	30
Alaska	-9	03	00
- Day light Saving Time	- 8	04	00
Albania	+ 1	13	00
- Day light Saving Time	+ 2	14	00
Aleutian Islands	- 10	02	00
Algeria	0	12	00
Angola	+ 1	13	00
Argentina	- 3	09	00
Ascension Islands	0	12	00
Australia-			
Capital Territory (Canberra), Victoria, New South Wales, Queensland, Tasmania.	+ 10	22	00
South Australia, Northern Territory, Broken Hill Area	+ 9 1/2	21	30
- Day light Saving Time	+ 10 1/2	22	30
Western Australia	+ 8	20	00
- Day light Saving Time	+ 9	21	00
Austral Islands	- 10	02	00
Austria	+ 1	13	00
Azores	- 1	11	00
Bahrain	+ 3	15	00
Bangladesh	+ 6	18	00

Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.	
	h	h	m
Belgium	+ 1	13	00
Belize	- 6Ψ	06	00Ψ
Bermuda	- 4	08	00
Bhutan	+ 6	18	00
Bolivia	- 4	08	00
Brazil-			
Eastern (including coast)	- 3*	09	00*
Western	- 3*	09	00*
Territory of Acre	- 4*	08	00*
Bulgaria	+ 2	14	00
Cambodia	+ 7	19	00
Cameroon	+ 1	13	00
Canada-			
Newfoundland	- 3 1/2*	08	30*
East of Long. 63° W N W Territories (Ea-St of Long. 68° W), New Brunswick Nova Scotia, Prince Edward Island	- 4*	08	00*
Quebec (West of Long.63°W), Ontario (East of Long 90° W) (Ottawa), Nunavut (East) and NW Territories (Long.. W 68°-85°)	- 5*	07	00*
Ontario (West of Long. 90° W), Manitoba, NW Territories (Long. W 85°-102°), East Saskatchewan, Nunavut (Central)	- 6*	06	00*
Alberta	- 7*	05	00*
Yukon Time	- 8	04	00
Canary Island	+ 1	13	00
Cape Verde Islands	- 1	11	00

STANDARD TIMES

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF (+) OR BEHIND (-) U.T. OR G.M.T

Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.		Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.	
	h	h	m		h	h	m
Caroline Islands-	+ 11	23	00	Ghana	0	12	00
Truk, Ponape	+ 11	23	00	Gibraltar	+ 1↓	13	00↓
Central African Republic	+ 1	13	00	Greece	+ 2	14	00
Chile	- 4*	08	00*	Greenland			
China, People's Republic of	+ 8	20	00	Angmagssalik, W. Coast	- 3	09	00
Cocos-keeling Islands	+ 6 1/2	18	30	Thule Area	- 4	08	00
Colombia	- 5	07	00	Guam	+ 10	22	00
Congo Republic	+ 1	13	00	Guatemala	- 6	06	00
Cook Islands	- 10	02	00	Guiana			
				Dutch (Surinam)	- 3	09	00
Corsica	+ 1↓	13	00↓	French	- 3	09	00
Costa Rica	- 6	06	00	Guyana Republic	- 4	08	00
Croatia	+1	13	00	Haiti	- 5	07	00
Cuba	- 5*	07	00*	Hawaiian Islands	- 10	02	00
Czech Republic	+1	13	00	Honduras	- 6	06	00
Cyprus	+ 2	14	00	Hong Kong	+ 8*	20	00*
Dahomey Republic (Africa)	+ 1	13	00	Hungary	+ 1	13	00
Denmark	+ 1	13	00	Iceland	0	12	00
Ecuador	- 5	07	00	India	+ 5 1/2	17	30
Egypt	+ 2*	14	00*	Indonesia, Republic of-	--	--	
Estonia	+ 2	14	00	Sumatra, Java, West & Central Kalimantan	+ 7	19	00
El Salvador	- 6	06	00	Bali, South & East Kalimantan	+ 8	20	00
Ethiopia	+ 3	15	00	Irian Jaya, Maluku	+ 9	21	00
Falkland Islands	-4	08	00	Iran	+ 3 1/2	15	30
Fiji	+12	24	00	Iraq	+ 3	15	00
Finland	+2	14	00	Ireland, Republic of	0	12	00
France	+1↓	13	00↓	Israel	+2	14	00
Germany	+1	13	00	Italy	+1*	13	00*

STANDARD TIMES

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF (+) OR BEHIND (-) U.T. OR G.M.T

Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.		Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.	
	h	h	m		h	h	m
Ivory Coast	0	12	00	Monaco	+ 1	13	00
Japan (and Japan Is.)	+ 9	21	00	Mongolia	+ 8	20	00
Jordan	+ 2	14	00	Morocco	0*	12	00*
Kenya	+ 3	15	00	Mozambique	+ 2	14	00
Korea (North & South)	+ 9	21	00	Nepal	+ 5 3/4	17	45
Kuwait	+ 3	15	00	Netherlands (Holland)	+ 1	13	00
Laos	+ 7	19	00	New Caledonia	+ 11	23	00
Latvia	+ 2	14	00	New Hebrides	+ 11	23	00
Lebanon	+ 2*	14	00*	New Zealand	+ 12	24	00
Liberia	0	12	00	Nicaragua	- 6	06	00
Libya	+ 2	14	00	Niger	+ 1	13	00
Lithuania	+ 3	15	00	Nigeria	+ 1	13	00
Luxembourg	+ 1↓	13	00↓	Norfolk Island	+ 11 1/2	23	30
Madagascar	+ 3	15	00	Norway	+ 1*	13	00*
Madeira	- 1*	11	00*	Oman (Masira, Muscat, Salalah)	+ 4	16	00
Malawi	+ 2	14	00	Pakistan	+ 5	17	00
Malaysia	+ 8	20	00	Papua New Guinea	+ 10	22	00
Maldives Island	+ 5	17	00	Paraguay	- 4	08	00
Malta	+ 1	13	00	Peru	- 5	07	00
Manchuria (China)	+ 8	20	00	Philippines	+ 8	20	00
Mariana Island	+ 10	22	00	Poland	+ 1*	13	00*
Marquesas Islands	- 9 1/2	02	30	Portugal	+ 1	13	00
Marshall Islands	+ 12	24	00	Puerto Rico	- 4	08	00
Mauritania	0	12	00	Reunion	+ 4	16	00
Mauritius	+ 4	16	00	Romania	+ 2	14	00
Mayanmar	+ 6 1/2	18	30	Sakhalin	+ 11	23	00
Mexico-				Samoa	- 11	01	00
Mexico City	- 6	06	00	Sardinia	+ 1	13	00
Sonora, Sinaloa, Nayarit, Baja California Sur	- 7	05	00				
Baja California	- 8	04	00				

STANDARD TIMES

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF (+) OR BEHIND (-) U.T. OR G.M.T

Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.		Country or Area	Standard Time	L.S.T at 12h U.T or 17-30 I.S.T.	
	h	h	m		h	h	m
Saudi Arabia-				Tangier	0	12	00
Jeddah	+ 3	15	00	Thailand	+ 7	19	00
Dhahran	+ 4	16	00	Uganda	+ 3	15	00
Senegal	0	12	00	Ukraine	+ 2	14	00
Serbia	+ 1	13	00	United Arab Emirates	+ 4	16	00
Sierra Leone	0	12	00	USA Aleutian	- 10*	02	00*
Singapore	+ 8	20	30	USA Hawaii	- 10*	02	00*
Solomon Islands	+ 11	23	00	USA Pacific	- 8*	04	00*
Somalia	+ 3	15	00	USA Mountain	- 7*	05	00*
South Africa	+ 2	14	00	USA Arizona	- 7*	05	00*
Spain	+ 1↓	13	00↓	USA Central	- 6*	06	00*
Sri Lanka	+ 5 1/2	17	30	USA Eastern	- 5*	07	00*
Sudan	+ 2	14	00	Uruguay	- 3	09	00
Sweden	+ 1	13	00	Uzbekistan	+ 5	17	00
Switzerland	+ 1	13	00	Zambia	+ 2	14	00
Syria	+ 2*	14	00*	Zimbabwe	+ 2	14	00
Tanzania	+ 3	15	00				

* During summer seasons clock time differs from Standard time.
Ψ Winter time may be kept in these countries.
↓ This time is used throughout the year, but may differ from legal time.

PART - VI

INDIAN CALENDAR
AND
EXPLANATION

INDIAN CALENDAR
EXPLANATORY NOTE

The astronomical data included in this section on Indian Calendar have been calculated in accordance with the recommendations of the Calendar Reform Committee, as outlined in its report, and the calculations have been done on the basis of the positions of the Sun, Moon and Planets, as contained in the main tables of the Ephemeris. However, the information on Luni- Solar Calendar in this section have been calculated on the basis of traditional Nirayana Calendric system following the Government's decision not to disturb the traditional procedure in fixing the days of religious festivals. Certain additional data, which are required for the compilation of an Indian Panchang (Almanac), have also been furnished to meet the requirements of the numerous Panchang makers of this country. The tables of this section have been extended beyond December, 2019 and materials up to April 20, 2020 have been furnished in order to facilitate preparation of Almanacs for one complete Indian year. The longitudes of the Sun, Moon and Planets and certain other data relating to their positions for the period of 2020 covered by this calendar have also been given in separate table for the same purpose.

All calculations contained in this section have been done for an adopted Central Station of India situated at $82^0 30^/$ longitude East of Greenwich and $23^0 11^/$ latitude North (latitude of Ujjain) and accordingly the timings have been expressed in the local mean time of this Central Station, which is also the Indian Standard Time. This time (I.S.T.) is $5^h 30^m$ ahead on the Universal Time or Greenwich Mean Time.

The Calendar used in this section is the 'National Calendar' of India as recommended by the Calendar Reform Committee and introduced by the Government of India with effect from the 22 nd March 1957, corresponding to the 1^{st} of Chaitra, 1879 Saka Era. Thereafter, Govt. of India has decided to introduce an all India Nirayana Solar Calendar in addition to the existing National Calendar. This new Calendar has been introduced with effect from 14th April, 2004 corresponding to 1st Vaisakha of 5105 Kali, Kali Era being the Era of this new Calendar and this Calendar have fixed number of days for its months. Dates of the Nirayana Calendar have been indicated in addition to the existing National Calendar. The months of these Calendars, the number of days assigned to each month of the two Calendars, and the dates of the Gregorian calendar corresponding to the first day of each month of both the Calendars are as follows :-

Months of the National Calendar	Gregorian date for 1st of the month	Months of the Nirayana Calendar	Gregorian date for 1st of the month
Chaitra (30 days ; 31 days in a leap-year)	March 22 (March 21 in a leap-year)	Vaisakha (31 days)	April 14
		Jyaishtha (31 days)	May 15
Vaisakha (31 days)	April 21	Ashadha (31 days)	June 15
Jyaishtha (31 days)	May 22	Sravana (31 days)	July 16
Ashadha (31 days)	June 22	Bhadra (31 days)	August 16
Sravana (31 days)	July 23	Asvina (30 days)	September 16
Bhadra (31 days)	August 23	Kartika (30 days)	October 16
Asvina (30 days)	September 23	Agrahayana (30 days)	November 15
Kartika (30 days)	October 23	Pausha (30 days)	December 15
Agrahayana (30 days)	November 22	Magha (30 days)	January 14
Pausha (30 days)	December 22	Phalguna (30 days ; 31 days in a leap-year)	February 13
Magha (30 days)	January 21		
Phalguna (30 days)	February 20	Chaitra (30 days)	March 15

Different items included in this section are elaborated below :-

The Sunrise and Sunset times, calculated for the Central Station, relate respectively to the appearance and disappearance of the upper limb of the Sun on the horizon. The amount of horizontal refraction taken for this purpose is $31^/$ and the semi-diameter of the Sun as $16^/$, so that at the given times of Sunrise and Sunset, the centre of the Sun actually $47^/$ below the horizon.

The apparent noon is the local mean time of the sun's meridian passage, i.e., the mid-day reduced to the above standard meridian of India ($82½^0$ E. Longitude).

The ending moments of tithis, nakshatras and yogas have been given in Indian Standard Time and shown against their ordinal numbers. The phenomena being geocentric ones, their timings in I.S.T. are applicable for the whole of India without any modification. These timings reduced by a deduction of $5^h 30^m$ would give the G.M.T. applicable for all places on the earth.

The tithi is based on the difference of longitude of the Moon and that of the Sun. A tithi is completed when the longitude of the Moon gains exactly 12^0 or its integral multiple on that of the Sun and as such there are 30 tithis in lunar month. A difference in longitude of 12^0 indicates the ending of the 1st tithi, 24^0 that of the 2nd tithi and so on. The number of tithis have been shown from Sukla 1 to Sukla 15 (full-moon) and again from Krishna 1 to Krishna 14 and Krishna 30 (new moon), using the symbols S and K for Sukla paksha (waxing Moon)and Krishna paksha (waning Moon) respectively.

A nakshatra is completed when the nirayana longitude of the Moon as measured from the initial point attains a value of 13° 20′ or an integral multiple thereof. When this longitude is 13° 20′ the 1st nakshatra ends and so on. There are thus 27 nakshatras in a sidereal month and the nakshatra divisions occupy fixed positions in the sphere of stars. In the case of the Sun the calculation also has been done on the same basis. But in this case, the time of Sun's entry into a nakshatra-division has been stated, whereas in the case of the Moon, the time of its exit from the division has been given.

Like nakshatras, there are 27 yogas. Yoga is calculated from the sum of nirayana longitudes of the Sun and the Moon. When the sum amounts to 13° 20′, the first yoga ends; when it amounts to 26° 40′, the second yoga ends, and so on. Thus, in all 27 yogas cover 360°. Names of the nakshatras and yogas have been given at the bottom of the table. It will be seen that two of the names Vyatipata and Vaidhriti occur also under Phenomena, where they have been treated as special yogas and calculated by a somewhat different rule. The 27 yogas which have got very little astronomical significance have been included in this publication only to meet the needs of Panchang where the yoga is also one of the components.

For the purpose of calculation of rasis, nakshatras and yogas, an initial point which occupies a fixed position on the ecliptic has been adopted as the origin for the measurement of longitudes. The position of this initial point coincides with the vernal equinoctial point of vernal equinox day of 285 A.D. For the purpose of assigning a precise position to it, the tropical longitude of this initial point has been adopted as 23° 15′ 00″ for 0^h on 21st March, 1956. The tropical longitude of this fixed initial point for any day is known as ayanamsa. The longitude of a celestial body measured from this initial point is known as nirayana longitude.

The entry into different rasis of the Moon and of the Sun have been shown at the bottom of the relevant pages of the calendar and the calculations have been done on the same basis as in the case of nakshatras, utilising the nirayana longitudes. Rasis, which cover arc of 30^0 of the zodiac belt, are measured along the ecliptic from the above-mentioned initial point.

The tithi, nakshatra and yoga as are current at Sunrise at the Central Station, have been shown against the date with their ending moments in I. S. T. When the time of these or any other phenomena falls after midnight and before the next Sunrise, the time has been expressed after adding 24^h to the I.S.T. without changing the date after midnight in order to maintain continuity of time-reckoning from one Sunrise to the next, in conformity with the system followed in Indian religious calendars.

The solar months recommended for the religious calendar, such as, Saura Vaisakha, Saura Jyaishtha, etc., by the Calendar Reform Committee in 1955 have been reckoned from the moments when the apparent longitude of the Sun equals 23° 15′, 53° 15′ and so on. The calculation for this purpose thus has not been done with a variable ayanamsa, as in the case of rasis and nakshatras, but with a fixed ayanamsa of 23° 15′. These months are shown for purpose of illustration only, but are not used in practice for actual luni-solar adjustment.

The lunar months for determining the dates of religious festivals are reckoned from one New-Moon to the next (Sukladi system or mukhya mana). The lunar month for this purpose is named after the Nirayana or Sidereal solar month in which the initial New-Moon from which the month starts, falls.

Phenomena mentioned in the table include New-Moon, Full-Moon, Sayana Vyatipata (when the sum of the tropical longitudes of the Sun and the Moon equals 180^0), Sayana Vaidhriti (when the above sum amounts to 360^0), eclipses, heliacal rising and setting of Venus, Mars and Jupiter and Jupiter's transit into rasis.

The principal festivals of different states have been fixed on the basis of the criterion stated here, but in doing so, the rules and conventions of the states concerned have been followed as far as practicable.

LIST OF HOLIDAYS

The list of holidays for the Government of India as well as for the State Governments have been prepared in a consolidated form and the dates fixed for them, have been shown in a separate table under the head 'Principal Festivals for Holidays'. The principal festivals of Moslems, Parsis, Jewish and Christians have also been shown separately.

AYANAMSA

The value of ayanamsa has been given in the calendar for the first day of the month and also in a separate table at the end at interval of three days.

The Sayana Vyatipata and Sayana Vaidhriti, reported under the column "Phenomena", are calculated on the basis of defination given in the report of Calendar Reform Committee. These are classified as the Calendar Reform Committee view and no way related to the 'mahapata yoga' defined in some Indian traditional texts (siddhantic treatises).

HELIACAL RISING AND SETTING OF PLANETS, 2020
(JANUARY TO APRIL)

Planet	National Date	Nirayana Date	Gregorian Date	Time (I.S.T) h	m
Mercury rises in the East	Magha 5, 1941 Saka	Magha 12, 5120 Kali	Jan. 25, 2020	29	32
Mercury sets in the East	Phalguna 1, 1941 Saka	Phalguna 8, 5120 Kali	Feb. 20, 2020	26	37
Mercury rises in the West	Phalguna 12, 1941 Saka	Phalguna 19, 5120 Kali	Mar. 2, 2020	17	17
Mercury sets in the West	Chaitra 29, 1942 Saka	Vaisakha 5, 5121 Kali	Apr. 18, 2020	11	19
Jupiter rises in the West	Pausha 18, 1941 Saka	Pausha 25, 5120 Kali	Jan. 8, 2020	30	33
Saturn rises in the West	Magha 9, 1941 Saka	Magha 16, 5120 Kali	Jan. 29, 2020	29	51

N.B.- Here East means the eastern horizon or west of the Sun and West means the western horizon or east of the Sun.

RETROGRESSION OF PLANETS, 2020
(JANUARY TO APRIL)

Planet		National Date	Nirayana Date	Gregorian Date	Time (I.S.T) h	m
Mercury	Retrograde	Magha 27, 1941 Saka	Phalguna 4, 5120 Kali	Feb. 16, 2020	30	24
Mercury	Direct	Phalguna 20, 1941 Saka	Phalguna 27, 5120 Kali	Mar 10, 2020	09	28
Uranus	Direct	Pausha 21, 1941 Saka	Pausha 28, 5120 Kali	Jan. 11, 2020	07	19
Pluto	Retrograde	Vaisakha 5, 1942 Saka	Vaisakha 12, 5121 Kali	Apr. 25, 2020	24	22

MEAN RAHU, 2020

Date		Longitude ° ′ ″	Date		Longitude ° ′ ″	Date		Longitude ° ′ ″
Jan.	-2	74 15 59	Feb.	7	72 08 48	Mar.	19	69 58 27
	8	73 44 11		17	71 37 00		29	69 26 39
	18	73 12 24		27	71 05 13	Apr.	8	68 54 51
Jan.	28	72 40 36	Mar.	9	70 30 14		18	68 23 03
							28	67 51 16

ECLIPSES, 2020
(JANUARY TO APRIL)

–

INDIAN CALENDAR

SAKA ERA 1940

Makara : Tapas
Winter (Sisira), 1st Month

Month of PAUSHA (30 days)

(*Nirayana*) 8 Pausha, 5119 Kali Era to (*Nirayana*) 7 Magha, 5119 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi			Nakshatra			Yoga		
									No.	Ending Moment		No.	Ending Moment		No.	Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2018 A.D.															
1	Sat	Dec. 22	6	37.4	11	58.4	17	19.6	S 15	23	18.5	5	23	14.7	23	13	00.1
2	Sun	23	6	37.9	11	58.9	17	20.1	K 1	20	11.9	6	20	51.4	24	9	19.3
															(25	29	29.1)
3	Mon	24	6	38.4	11	59.4	17	20.7	2	16	58.7	7	18	21.8	26	25	36.8
4	Tue	25	6	38.8	11	59.9	17	21.2	3	13	47.7	8	15	55.0	27	21	49.1
5	Wed	26	6	39.3	12	00.4	17	21.8	4	10	46.9	9	13	39.1	1	18	12.1
6	Thu	27	6	39.7	12	00.9	17	22.4	K 5	8	03.3	10	11	41.2	2	14	50.8
7	Fri	28	6	40.1	12	01.4	17	23.0	7	27	49.7	11	10	06.9	3	11	49.3
8	Sat	29	6	40.5	12	01.9	17	23.6	8	26	26.8	12	9	00.2	4	9	10.3
9	Sun	30	6	40.8	12	02.4	17	24.2	9	25	35.6	13	8	23.7	5	6	55.8
															(6	29	06.2)
10	Mon	31	6	41.2	12	02.8	17	24.8	K 10	25	16.5	14	8	18.3	7	27	41.5
		2019 A.D.															
11	Tue	Jan. 1	6	41.5	12	03.3	17	25.4	11	25	28.6	15	8	43.9	8	26	40.9
12	Wed	2	6	41.8	12	03.8	17	26.1	12	26	10.8	16	9	39.3	9	26	03.1
13	Thu	3	6	42.1	12	04.3	17	26.7	13	27	21.2	17	11	03.0	10	25	46.7
14	Fri	4	6	42.3	12	04.7	17	27.4	14	28	57.9	18	12	53.1	11	25	50.2
15	Sat	5	6	42.6	12	05.2	17	28.1	K 30	-	-	19	15	07.4	12	26	11.6
16	Sun	6	6	42.8	12	05.6	17	28.8	K 30	6	58.2	20	17	42.9	13	26	48.5
17	Mon	7	6	43.0	12	06.1	17	29.4	S 1	9	18.7	21	20	35.7	14	27	37.7
18	Tue	8	6	43.2	12	06.5	17	30.1	2	11	54.3	22	23	40.4	15	28	34.9
19	Wed	9	6	43.3	12	06.9	17	30.8	3	14	38.5	23	26	49.6	16	29	34.3
20	Thu	10	6	43.4	12	07.3	17	31.5	4	17	22.1	24	29	54.0	17	30	29.3
21	Fri	11	6	43.5	12	07.7	17	32.2	S 5	19	54.8	25	-	-	18	-	-
22	Sat	12	6	43.6	12	08.1	17	33.0	6	22	05.1	25	8	43.0	18	7	12.1
23	Sun	13	6	43.7	12	08.5	17	33.7	7	23	42.2	26	11	05.7	19	7	34.8
24	Mon	14	6	43.7	12	08.9	17	34.4	8	24	37.5	27	12	52.4	20	7	30.0
25	Tue	15	6	43.7	12	09.2	17	35.1	9	24	45.2	1	13	55.7	21	6	52.0
															(22	29	36.9)
26	Wed	16	6	43.7	12	09.6	17	35.8	S 10	24	03.7	2	14	11.8	23	27	43.5
27	Thu	17	6	43.7	12	09.9	17	36.5	11	22	34.5	3	13	40.4	24	25	13.1
28	Fri	18	6	43.6	12	10.3	17	37.2	12	20	22.4	4	12	24.8	25	22	08.9
29	Sat	19	6	43.5	12	10.6	17	38.0	13	17	34.4	5	10	31.0	26	18	36.4
30	Sun	20	6	43.4	12	10.9	17	38.7	S 14	14	19.2	6	8	07.0	27	14	41.9
												(7	29	22.3)			

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1940

Uttarayana | Dakshina Gola | Month of PAUSHA (30 days) | Ayanamsa on 1st : 24° 07′ 04″

(*Nirayana*) 8 Pausha, 5119 Kali Era to (*Nirayana*) 7 Magha, 5119 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2018 A.D.					
1	Dec. 22	SAURA PAUSHA	CHAANDRA MARGASHIRSHA		1- Sayana Vaidhriti ($20^h 45^m.9$)	1- Uttarayana day, Sri Datta Jayanti (Maharashtra), Margi Purnima, Dattatreya Jayanti.
2	23				1- Full Moon ($23^h 18^m.5$)	2- Arudra Darshanam (S. India) (Purvarunodaya).
3	24					
4	25					4- Birthday of Sadhu T. L. Vaswani (Sindhi).
5	26					5- Jor Mela- 3 days (Punjab).
6	27					
7	28					
8	29			8- Enters Purvashadha ($11^h 27^m.3$)		8- Ashtaka (Pupashtaka).
9	30					
10	31					10- Birthday of Parsvanatha (Jain).
	2019 A.D.					
11	Jan. 1					11- Saphala Ekadasi.
12	2					
13	3				13- Sayana Vyatipata ($23^h 00^m.2$)	
14	4					
15	5				15-16 Solar Eclipse (not visible in India)	15- Vakula Amavasya (Odisha).
16	6		CHAANDRA PAUSHA		16- New Moon ($6^h 58^m.2$)	
17	7					
18	8					
19	9					
20	10					
21	11			21- Enters Uttarashadha ($13^h 20^m.6$)		
22	12					
23	13			23- Saura Maghadi ($23^h 23^m.2$)		23- Guru Govind Singh's Birthday Lohri (Punjab,J&K).
24	14					24- Bhogi(S. India), Birthday of Sant Paramanand (Sindhi), Magha Bihu (Assam), Makara Samkranti (Bengal).
25	15	SAURA MAGHA				25- Pongal (S. India), Makaradi Snana,Tila Samkranti, Tai Pongal (Kerala), Tamil New Year's Day, Makara Snana.
26	16					26- Mattu Pongal or Kanuvu(S. India), Samba Dasami (Odisha).
27	17				27- Sayana Vaidhriti ($11^h 56^m.9$)	27- Putrada ekadasi.
28	18					
29	19					
30	Jan. 20			30- Enters Tropical Aquarius ($14^h 29^m.5$)		

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Mithuna 1, $12^h 21^m.0$; Karkata 3, $12^h 59^m.3$; Simha 5, $13^h 39^m.1$; Kanya 7, $15^h 47^m.5$; Tula 9, $20^h 17^m.1$; Vrischika 11, $27^h 22^m.7$; Dhanus 14, $12^h 53^m.1$; Makara 16, $24^h 24^m.6$; Kumbha 19, $13^h 15^m.0$; Mina 21, $26^h 02^m.8$; Mesha 24, $12^h 52^m.4$; Vrisha 26, $20^h 08^m.3$; Mithuna 28, $23^h 32^m.2$; Karkata 30, $24^h 04^m.9$; Sun enters :- Nirayana Makara 24, $19^h 51^m.5$.

INDIAN CALENDAR

SAKA ERA 1940

Kumbha : Tapasya

Winter (Sisira), 2nd Month

Month of MAGHA (30 days)

(*Nirayana*) 8 Magha, 5119 Kali Era to (*Nirayana)* 7 Phalguna, 5119 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi			Nakshatra			Yoga		
									No.	Ending Moment		No.	Ending Moment		No.	Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Mon	Jan. 21	6	43.3	12	11.2	17	39.4	S 15	10	46.1	8	26	27.0	1	10	33.0
															(2	30	17.4)
2	Tue	22	6	43.1	12	11.4	17	40.1	K 1	7	05.0	9	23	31.7	3	26	03.4
									(2	27	26.2)						
3	Wed	23	6	42.9	12	11.7	17	40.8	3	23	59.4	10	20	46.6	4	21	58.8
4	Thu	24	6	42.7	12	12.0	17	41.5	4	20	54.1	11	18	21.4	5	18	11.1
5	Fri	25	6	42.5	12	12.2	17	42.2	K 5	18	18.4	12	16	24.9	6	14	46.7
6	Sat	26	6	42.3	12	12.4	17	42.9	6	16	19.5	13	15	04.3	7	11	51.1
7	Sun	27	6	42.0	12	12.6	17	43.6	7	15	02.4	14	14	24.4	8	9	28.3
8	Mon	28	6	41.7	12	12.8	17	44.3	8	14	29.6	15	14	27.9	9	7	40.1
															(10	30	26.6)
9	Tue	29	6	41.4	12	13.0	17	45.0	9	14	40.9	16	15	14.2	11	29	45.7
10	Wed	30	6	41.0	12	13.2	17	45.6	K 10	15	33.5	17	16	40.0	12	29	34.0
11	Thu	31	6	40.7	12	13.4	17	46.3	11	17	02.1	18	18	40.0	13	29	46.6
12	Fri	Feb. 1	6	40.3	12	13.5	17	47.0	12	18	59.7	19	21	07.3	14	30	18.2
13	Sat	2	6	39.9	12	13.6	17	47.7	13	21	19.0	20	23	54.5	15	-	-
14	Sun	3	6	39.5	12	13.8	17	48.3	14	23	52.6	21	26	54.7	15	7	03.6
15	Mon	4	6	39.0	12	13.9	17	49.0	K 30	26	33.6	22	30	01.1	16	7	57.6
16	Tue	5	6	38.6	12	13.9	17	49.6	S 1	29	15.6	23	-	-	17	8	55.7
17	Wed	6	6	38.1	12	14.0	17	50.2	2	-	-	23	9	07.8	18	9	53.6
18	Thu	7	6	37.6	12	14.1	17	50.9	2	7	52.5	24	12	08.9	19	10	47.0
19	Fri	8	6	37.1	12	14.1	17	51.5	3	10	18.2	25	14	58.5	20	11	31.7
20	Sat	9	6	36.5	12	14.2	17	52.1	4	12	26.1	26	17	30.1	21	12	03.0
21	Sun	10	6	36.0	12	14.2	17	52.7	S 5	14	09.2	27	19	37.0	22	12	16.0
22	Mon	11	6	35.4	12	14.2	17	53.3	6	15	20.8	1	21	12.4	23	12	05.7
23	Tue	12	6	34.8	12	14.2	17	53.9	7	15	54.8	2	22	10.6	24	11	27.5
24	Wed	13	6	34.2	12	14.2	17	54.5	8	15	46.7	3	22	27.4	25	10	17.5
25	Thu	14	6	33.5	12	14.2	17	55.1	9	14	54.5	4	22	01.0	26	8	33.5
															(27	30	14.7)
26	Fri	15	6	32.9	12	14.1	17	55.7	S 10	13	18.6	5	20	52.4	1	27	22.5
27	Sat	16	6	32.2	12	14.1	17	56.2	11	11	02.0	6	19	05.2	2	24	00.1
28	Sun	17	6	31.5	12	14.0	17	56.8	12	8	10.2	7	16	45.6	3	20	12.4
									(13	28	50.5)						
29	Mon	18	6	30.8	12	13.9	17	57.3	14	25	11.6	8	14	01.6	4	16	06.0
30	Tue	19	6	30.1	12	13.9	17	57.9	S 15	21	23.6	9	11	02.8	5	11	48.3

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Uttarayana — SAKA ERA 1940

Dakshina Gola — Month of MAGHA (30 days) — Ayanamsa on 1st : 24° 07′ 10″

(*Nirayana*) 8 Magha, 5119 Kali Era to (*Nirayana*) 7 Phalguna, 5119 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D.					
1	Jan. 21	SAURA MAGHA	CHAANDRA PAUSHA		1- Full Moon ($10^h 46^m.1$) 1- LunarEclipse not visible in India	1- Martyrdom Day of Hemu Kalani (Sindhi), Floating Festival (Tai Poosam), Pushyabhisheka Yatra, Paushi Purnima.
2	22					
3	23					3- Netaji's Birthday.
4	24			4- Enters Sravana nak. ($15^h 41^m.6$)		4- Ganesha Sankashta Chaturthi.
5	25					
6	26					6- Republic Day.
7	27					7- Birthday of Swami Vivekananda (according to tithi).
8	28				8- Sayana Vyatipata ($27^h 45^m.2$)	8- Ashtaka (Mamashtaka), Birthday of Lala Lajpat Rai.
9	29					
10	30					10- Martyr's Day (Mahatma Gandhi Commemoration Day).
11	31					11- Sattila Ekadasi.
12	Feb. 1					
13	2					13- Meru Trayodasi (Jain), Ratanti Kalika Puja.
14	3					
15	4				15- New Moon ($26^h 33^m.6$)	15- Mauni Amavasya (Monday), Mahodaya Yoga (after $7^h 58^m$), Tai Amavasya, Makara Vavu (Kerala), Ardra Kumbha Parva at Allahabad.
16	5		CHAANDRA MAGHA			16- Magha Sukladi.
17	6			17- Enters Dhanishtha ($18^h 47^m.4$)		
18	7					
19	8					19- Tila Chaturthi, Kunda Chaturthi.
20	9					20- Varada Chaturthi, Ganesa Puja (Bengal).
21	10					21- Sri Panchami, Sarasvati Puja, Vasanta Panchami.
22	11				22- Sayana Vaidhriti ($21^h 00^m.6$)	
23	12			23- Saura Phalgunadi ($12^h 09^m.7$)		23- Ratha Saptami (Purvarunodaya), Vidhana Saptami, Arogya Saptami.
24	13	SAURA PHALGUNA				24- Bhismashtami.
25	14					
26	15					
27	16					27- Jaya Ekadasi, Bhaimi Ekadasi (Bengal), Bhishma Dvadasi.
28	17					28- Desert Festival- 3 days(Jaisalmer).
29	18			29- Enters Trop. Pisces ($28^h 33^m.9$)		
30	Feb. 19			30- Enters Satabhisaj ($23^h 18^m.1$)	30- Full Moon ($21^h 23^m.6$)	30- Maghi Purnima, Guru Ravi Das's Birthday (according to tithi), Masi Magham, Sivaji Jayanti.

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Simha 2, $23^h 31^m.7$; Kanya 4, $23^h 49^m.3$; Tula 6, $26^h 39^m.0$; Vrischika 9, $8^h 58^m.7$; Dhanus 11, $18^h 40^m.0$; Makara 13, $30^h 38^m.6$; Kumbha 16, $19^h 34^m.8$; Mina 19, $8^h 17^m.5$; Mesha 21, $19^h 37^m.0$; Vrisha 23, $28^h 18^m.8$; Mithuna 26, $9^h 31^m.9$; Karkata 28, $11^h 23^m.1$; Simha 30, $11^h 02^m.8$; Sun enters :- Nirayana Kumbha 24, $8^h 48^m.7$.

INDIAN CALENDAR

SAKA ERA 1940

Mina : Madhu
Spring (Vasanta), 1st Month

Month of PHALGUNA (30 days)

(*Nirayana*) 8 Phalguna, 5119 Kali Era to (*Nirayana*) 7 Chaitra, 5119 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Wed	Feb. 20	6	29.4	12	13.8	17	58.4	K 1	17	36.8	10	7	59.8	6	7	27.5
												(11	29	03.8)	(7	27	12.2)
2	Thu	21	6	28.6	12	13.7	17	58.9	2	14	02.1	12	26	26.1	8	23	11.2
3	Fri	22	6	27.9	12	13.5	17	59.4	3	10	50.2	13	24	17.4	9	19	32.8
4	Sat	23	6	27.1	12	13.4	17	59.9	4	8	11.1	14	22	47.1	10	16	24.2
									(K 5	30	13.7)						
5	Sun	24	6	26.3	12	13.3	18	00.4	6	29	04.5	15	22	02.5	11	13	51.4
6	Mon	25	6	25.5	12	13.1	18	00.9	7	28	47.1	16	22	07.8	12	11	58.2
7	Tue	26	6	24.7	12	13.0	18	01.4	8	29	20.8	17	23	03.4	13	10	45.7
8	Wed	27	6	23.9	12	12.8	18	01.9	9	-	-	18	24	45.3	14	10	12.3
9	Thu	28	6	23.1	12	12.6	18	02.4	9	6	41.1	19	27	05.9	15	10	13.3
10	Fri	Mar. 1	6	22.2	12	12.4	18	02.8	K 10	8	39.4	20	29	54.5	16	10	42.0
11	Sat	2	6	21.4	12	12.2	18	03.3	11	11	04.6	21	-	-	17	11	30.2
12	Sun	3	6	20.5	12	12.0	18	03.8	12	13	44.8	21	8	59.5	18	12	29.5
13	Mon	4	6	19.6	12	11.8	18	04.2	13	16	28.7	22	12	09.9	19	13	32.0
14	Tue	5	6	18.7	12	11.6	18	04.7	14	19	07.3	23	15	16.5	20	14	31.3
15	Wed	6	6	17.9	12	11.4	18	05.1	K 30	21	34.0	24	18	12.7	21	15	22.5
16	Thu	7	6	17.0	12	11.1	18	05.5	S 1	23	44.0	25	20	53.7	22	16	02.2
17	Fri	8	6	16.0	12	10.9	18	06.0	2	25	34.5	26	23	16.4	23	16	27.9
18	Sat	9	6	15.1	12	10.7	18	06.4	3	27	02.9	27	25	18.3	24	16	37.7
19	Sun	10	6	14.2	12	10.4	18	06.8	4	28	06.8	1	26	57.0	25	16	29.9
20	Mon	11	6	13.3	12	10.2	18	07.2	S 5	28	43.5	2	28	09.7	26	16	02.5
21	Tue	12	6	12.3	12	09.9	18	07.6	6	28	50.0	3	28	53.2	27	15	13.2
22	Wed	13	6	11.4	12	09.6	18	08.0	7	28	23.4	4	29	04.7	1	13	59.5
23	Thu	14	6	10.4	12	09.3	18	08.4	8	27	21.8	5	28	41.9	2	12	19.3
24	Fri	15	6	09.5	12	09.1	18	08.8	9	25	44.6	6	27	44.1	3	10	11.1
25	Sat	16	6	08.5	12	08.8	18	09.2	S 10	23	33.0	7	26	12.7	4	7	34.7
															(5	28	31.3)
26	Sun	17	6	07.6	12	08.5	18	09.6	11	20	50.8	8	24	11.3	6	25	03.8
27	Mon	18	6	06.6	12	08.2	18	10.0	12	17	43.5	9	21	46.0	7	21	16.9
28	Tue	19	6	05.6	12	07.9	18	10.4	13	14	18.6	10	19	04.7	8	17	16.7
29	Wed	20	6	04.7	12	07.6	18	11.2	14	10	45.0	11	16	17.1	9	13	10.6
30	Thu	21	6	03.7	12	07.3	18	11.2	S 15	7	12.9	12	13	33.8	10	9	06.8
									(K 1	27	52.8)				(11	29	13.9)

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1940

Uttarayana
Dakshina Gola

Month of PHALGUNA (30 days)

Ayanamsa on 1st : $24^{0}07^{\prime}14^{\prime\prime}$

(*Nirayana*) 8 Phalguna, 5119 Kali Era to (*Nirayana)* 7 Chaitra, 5119 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D.					
1	Feb. 20	SAURA PHALGUNA	CHAANDRA MAGHA			
2	21					
3	22					
4	23				4- Sayana Vyatipata ($13^h 59^m.5$)	
5	24					
6	25					
7	26					7- Ashtaka (Sakashtaka), Janaki Janma, Vaikkatashtami (Kerala).
8	27					
9	28					
10	Mar. 1					10- Birthday of Swami Dayananda Saraswati (Founder of Arya Samaj)(according to tithi).
11	2					11- Vijaya Ekadasi.
12	3					12- Maha Sivaratri (Kashmir).
13	4			13- Enters Purva Bhadrapada ($29^h 36^m.6$)		13- Maha Sivaratri, Sivaratri (S. India).
14	5					
15	6				15- New Moon ($21^h 34^m.0$)	
16	7		CHAANDRA PHALGUNA			
17	8				17- Sayana Vaidhriti ($25^h 42^m.5$)	17- Birthday of Sri Ramakrishna (according to tithi).
18	9					
19	10					
20	11					
21	12					
22	13					
23	14			23- Saura Chaitradi ($8^h 42^m.1$)		22- Holashtaka.
24	15	SAURA CHAITRA				
25	16					
26	17					
27	18			27- Enters Uttara Bhadrapada ($14^h 00^m.5$)		26- Amlaki Ekadasi.
28	19					
29	20			29- Enters Trop. Aries ($27^h 28^m.4$)		29- Holikadahana.
30	Mar. 21				30- Full Moon ($7^h 12^m.9$) 30- Sayana Vyatipata ($6^h 45^m.5$)	30- Birthday of Sri Chaitanya, Holi, Dolyatra, Hola, Vasantotsava, Panguni Uttiram, Maha Vishuva Day, Indian Year Ending day.
	1941 S.E.					
Chtr. 1	Mar. 22					1- Indian New Year's Day.

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½^0 E. Long.

Moon enters :- Kanya 2, $10^h 22^m.3$; Tula 4, $11^h 26^m.9$; Vrischika 6, $16^h 01^m.6$; Dhanus 8, $24^h 45^m.3$; Makara 11, $12^h 39^m.6$; Kumbha 13, $25^h 44^m.2$; Mina 16, $14^h 15^m.1$; Mesha 18, $25^h 18^m.3$; Vrisha 21, $10^h 23^m.4$; Mithuna 23, $16^h 57^m.6$; Karkata 25, $20^h 38^m.5$; Simha 27, $21^h 46^m.0$; Kanya 29, $21^h 35^m.4$; Sun enters: Nirayana Mina 23, $29^h 40^m.0$.

INDIAN CALENDAR

SAKA ERA 1941 — Mesha : Madhava

Month of CHAITRA (30 days) — Spring (Vasanta), 2nd Month

(*Nirayana*) 8 Chaitra, 5119 Kali Era to (*Nirayana*) 7 Vaisakha, 5120 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi				Nakshatra			Yoga		
										No.		Ending Moment		No.	Ending Moment		No.	Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2019 A.D.																	
1	Fri	Mar.	22	6	02.7	12	07.0	18	11.5	K	2	24	55.9	13	11	06.1	12	25	40.7
2	Sat		23	6	01.7	12	06.7	18	11.9		3	22	32.5	14	9	05.2	13	22	35.2
3	Sun		24	6	00.8	12	06.4	18	12.3		4	20	51.6	15	7	41.3	14	20	04.3
4	Mon		25	5	59.8	12	06.1	18	12.7	K	5	20	00.3	16	7	02.9	15	18	12.9
5	Tue		26	5	58.8	12	05.8	18	13.0		6	20	01.9	17	7	15.0	16	17	03.2
6	Wed		27	5	57.8	12	05.5	18	13.4		7	20	55.3	18	8	18.8	17	16	34.1
7	Thu		28	5	56.9	12	05.2	18	13.8		8	22	34.4	19	10	10.3	18	16	41.2
8	Fri		29	5	55.9	12	04.9	18	14.1		9	24	48.3	20	12	40.7	19	17	16.9
9	Sat		30	5	54.9	12	04.6	18	14.5	K	10	27	23.2	21	15	37.5	20	18	11.6
10	Sun		31	5	54.0	12	04.3	18	14.9		11	-	-	22	18	46.4	21	19	14.8
11	Mon	Apr.	1	5	53.0	12	04.0	18	15.3		11	6	04.4	23	21	54.0	22	20	16.9
12	Tue		2	5	52.0	12	03.7	18	15.6		12	8	38.8	24	24	49.2	23	21	09.6
13	Wed		3	5	51.1	12	03.4	18	16.0		13	10	56.5	25	27	24.5	24	21	47.4
14	Thu		4	5	50.1	12	03.1	18	16.4		14	12	51.3	26	29	35.9	25	22	06.8
15	Fri		5	5	49.2	12	02.9	18	16.8	K	30	14	20.5	27	-	-	26	22	06.5
16	Sat		6	5	48.2	12	02.6	18	17.1	S	1	15	23.5	27	7	22.3	27	21	46.5
17	Sun		7	5	47.3	12	02.3	18	17.5		2	16	01.6	1	8	44.2	1	21	07.5
18	Mon		8	5	46.3	12	02.0	18	17.9		3	16	15.9	2	9	42.8	2	20	10.3
19	Tue		9	5	45.4	12	01.7	18	18.3		4	16	07.3	3	10	19.1	3	18	55.5
20	Wed		10	5	44.5	12	01.5	18	18.6	S	5	15	36.2	4	10	33.4	4	17	22.9
21	Thu		11	5	43.6	12	01.2	18	19.0		6	14	42.0	5	10	25.2	5	15	32.0
22	Fri		12	5	42.7	12	01.0	18	19.4		7	13	24.0	6	9	53.8	6	13	22.3
23	Sat		13	5	41.8	12	00.7	18	19.8		8	11	41.7	7	8	58.5	7	10	53.1
24	Sun		14	5	40.9	12	00.4	18	20.2		9	9	35.8	8	7	39.7	8	8	04.8
																	(9	28	58.9)
25	Mon		15	5	40.0	12	00.2	18	20.6	S	10	7	08.4	9	5	59.3	10	25	38.1
											(11	28	23.2)	(10	28	00.9)			
26	Tue		16	5	39.1	12	00.0	18	21.0		12	25	26.1	11	25	50.4	11	22	06.8
27	Wed		17	5	38.2	11	59.7	18	21.4		13	22	24.3	12	23	35.6	12	18	30.7
28	Thu		18	5	37.4	11	59.5	18	21.8		14	19	26.5	13	21	25.3	13	14	56.6
29	Fri		19	5	36.5	11	59.2	18	22.2	S	15	16	42.2	14	19	29.4	14	11	32.0
30	Sat		20	5	35.7	11	59.0	18	22.6	K	1	14	21.2	15	17	58.2	15	08	24.6

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1941

Month of CHAITRA (30 days)

Uttarayana
Uttara Gola

Ayanamsa on 1st : 24^0 07$'$ 16$''$

(*Nirayana*) 8 Chaitra, 5119 Kali Era to (*Nirayana)* 7 Vaisakha, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D	SAURA CHAITRA	CHAANDRA PHALGUNA			
1	Mar. 22					1- Indian New Year's Day.
2	23					
3	24					
4	25					4- Ranga Panchami, Bijoy Govindji Halangkar (Manipur).
5	26					
6	27					
7	28					7- Varsitaparambha (Jain), Sitalashtami.
8	29				8- Jupiter enters Dhanus (20^h 05^m.2)	
9	30					
10	31			10- Enters Revati (24^h 53^m.6)		
11	Apr. 1					11- Papamochani Ekadasi.
12	2					12- Varuni (trayodasi after 8^h 39^m) Satavisaj upto 24^h 49^m.
13	3				13 -Sayana Vaidhriti (6^h 35^m.6)	13- Madhukrishna Trayodasi.
14	4					
15	5				15-New Moon (14^h 20^m.5)	15- Birthday anniversary of Swami Leela Shah (Sindhi).
16	6		CHAANDRA CHAITRA			16- Chaitra Sukladi (Gudi Padava, Ugadi), Telugu New Year's Day, Vasanta Navaratrarambha, Cheti Chand (Sindhi New Year's Day).
17	7					
18	8					18- Gauri Tritiya (Gangaur), Sarhul (Bihar), Andolana Tritiya.
19	9					
20	10					20- Sri (Lakshmi) Panchami.
21	11					21- Skanda Shasthi, Oli begins (Jain).
22	12					22- Vasanti Pujarambha.
23	13			23- Saura Vaisakhadi (16^h 48^m .0)		23- Asokashtami, Annapurna Puja, Mela Bahu Fort (Jammu), Rama Navami (Smarta).
24	14			24- Enters Asvini (14^h 09^m .1)		24- Chaitra Samkranti, Vaisakhi (H.P, Punjab, Haryana, Delhi, Odisha), Visu (Kerala), Mesha Samkranti (Odisha), Chadaka Puja (Bengal), Dr. B.R. Ambedkar Jayanti, Ram Navami (Vaishnava), Rangali Bihu (Assam), Cheiraoba (Manipur), Beginning of Nirayana 5120 KE, Mesadi (T.N.).
25	15	SAURA VAISAKHA			25-Sayana Vyatipata (23^h 10^m.7)	25- Bahag Bihu (Assam), Vaisakhadi (Bengal), Shilhenba (Manipur), Kamada Ekadasi (Smarta).
26	16					26- Ekadasi (Vaishnava & Vidhava).
27	17					27- Ananga Trayodasi, Mahavira Jayanti (Jain).
28	18					28- Damanaka Chaturdasi.
29	19				29-Full Moon (16^h 42^m.2)	29- Chaitri Purnima, Hanumat Jayanti (S. India), Oli ends (Jain), Trivandrum Arat (Kerala).
30	Apr. 20			30- Enters Trop. Taurus (14^h 25^m.3)		

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Tula 1, 22^h 01^m.7; Vrischika 3, 25^h 08^m.0; Dhanus 6, 8^h 18^m.8; Makara 8, 19^h 23^m.0; Kumbha 11, 8^h 21^m.2; Mina 13, 20^h 47^m.8; Mesha 16, 7^h 22^m.3; Vrisha 18, 15^h 54^m.0; Mithuna 20, 22^h 32^m.2; Karkata 22, 27^h 14^m.6; Simha 25, 5^h 59^m.3; Kanya 27, 7^h 16^m.8; Tula 29, 8^h 24^m.9;

Sun enters :- Nirayana Mesha 24, 14^h 09^m.1.

INDIAN CALENDAR

SAKA ERA 1941

Vrisha : Sukra

Month of VAISAKHA (31 days)

Summer (Grishma), 1st Month

(*Nirayana*) 8 Vaisakha, 5120 Kali Era to (*Nirayana*) 7 Jyaishtha, 5120 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Sun	Apr. 21	5	34.9	11	58.8	18	23.0	K 2	12	32.8	16	17	00.9	16	5	42.0
															(17	27	30.6)
2	Mon	22	5	34.0	11	58.6	18	23.0	3	11	25.2	17	16	45.3	18	25	55.4
3	Tue	23	5	33.2	11	58.4	18	23.8	4	11	04.2	18	17	16.4	19	24	58.4
4	Wed	24	5	32.5	11	58.2	18	24.3	5	11	32.2	19	18	35.0	20	24	39.2
5	Thu	25	5	31.7	11	58.0	18	24.7	6	12	46.7	20	20	37.2	21	24	53.4
6	Fri	26	5	30.9	11	57.9	18	25.1	7	14	40.4	21	23	14.0	22	25	33.6
7	Sat	27	5	30.2	11	57.7	18	25.5	8	17	01.2	22	26	12.4	23	26	30.0
8	Sun	28	5	29.4	11	57.6	18	26.0	9	19	34.3	23	29	17.4	24	27	31.5
9	Mon	29	5	28.7	11	57.4	18	26.4	K 10	22	04.4	24	-	-	25	28	27.6
10	Tue	30	5	28.0	11	57.3	18	26.9	11	24	17.9	24	8	14.6	26	29	09.2
11	Wed	May 1	5	27.3	11	57.2	18	27.3	12	26	05.3	25	10	51.9	27	-	-
12	Thu	2	5	26.6	11	57.0	18	27.7	13	27	21.1	26	13	01.6	27	5	29.9
13	Fri	3	5	25.9	11	56.9	18	28.2	14	28	04.0	27	14	40.0	1	5	26.2
															(2	28	57.0)
14	Sat	4	5	25.3	11	56.8	18	28.7	K 30	28	15.5	1	15	46.8	3	28	03.5
15	Sun	5	5	24.6	11	56.7	18	29.1	S 1	27	58.9	2	16	24.4	4	26	47.9
16	Mon	6	5	24.0	11	56.6	18	29.6	2	27	18.1	3	16	36.5	5	25	13.0
17	Tue	7	5	23.4	11	56.6	18	30.0	3	26	17.2	4	16	27.0	6	23	21.9
18	Wed	8	5	22.8	11	56.5	18	30.5	4	24	59.3	5	15	59.6	7	21	16.9
19	Thu	9	5	22.3	11	56.5	18	31.0	S 5	23	26.9	6	15	17.0	8	19	00.0
20	Fri	10	5	21.7	11	56.4	18	31.4	6	21	41.7	7	14	21.1	9	16	32.5
21	Sat	11	5	21.2	11	56.4	18	31.9	7	19	44.7	8	13	13.3	10	13	55.4
22	Sun	12	5	20.6	11	56.4	18	32.4	8	17	37.3	9	11	54.7	11	11	09.5
23	Mon	13	5	20.1	11	56.4	18	32.8	9	15	21.3	10	10	27.0	12	8	16.2
															(13	29	17.3)
24	Tue	14	5	19.7	11	56.4	18	33.3	S 10	12	59.5	11	8	52.9	14	26	15.6
25	Wed	15	5	19.2	11	56.4	18	33.8	11	10	35.8	12	7	16.0	15	23	15.0
26	Thu	16	5	18.7	11	56.4	18	34.3	12	8	15.5	13	5	41.7	16	20	20.2
												(14	28	16.3)			
27	Fri	17	5	18.3	11	56.4	18	34.7	13	6	04.9	15	27	07.1	17	17	36.6
									(14	28	11.0)						
28	Sat	18	5	17.9	11	56.4	18	35.2	S 15	26	41.4	16	26	21.7	18	15	09.9
29	Sun	19	5	17.5	11	56.5	18	35.7	K 1	25	43.0	17	26	07.2	19	13	05.7
30	Mon	20	5	17.1	11	56.5	18	36.1	2	25	21.6	18	26	29.2	20	11	28.9
31	Tue	21	5	16.8	11	56.6	18	36.6	K 3	25	40.8	19	27	31.2	21	10	23.2

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1941

Month of VAISAKHA (31 days)

Uttarayana
Uttara Gola

Ayanamsa on 1st : 24° 07′ 19″

(*Nirayana*) 8 Vaisakha, 5120 Kali Era to (*Nirayana*) 7 Jyaishtha, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019A.D.					
1	Apr. 21	SAURA VAISAKHA	CHAANDRA CHAITRA			
2	22				2- Jupiter enters Vrischika ($25^h 13^m.6$)	
3	23					3- Babu Kuer Singh Day (Bihar).
4	24					
5	25					
6	26					
7	27					
8	28			8- Enters Bharani ($6^h 03^m.5$)	8- Sayana Vaidhriti ($12^h 02^m.5$)	
9	29					
10	30					10- Varuthini Ekadasi, Sri Vallabhacharya Jayanti.
11	May 1					11- May Day
12	2					
13	3					13- Birthday anniversary of Dada Chellaram (Sindhi).
14	4				14- New Moon ($28^h 15^m.5$)	
15	5					15- Tithi of Deva Damodara (Assam)
16	6		CHAANDRA VAISAKHA			
17	7					17- Parasuram Jayanti, Kedar Badri Yatra, Akshaya Tritiya, Varshitapa Samapana (Jain).
18	8					
19	9					19- Sri Ramanujacharya Jayanti (S.India), Sri Shankaracharya Jayanti, Birthday of Rabindranath Tagore.
20	10					20- Sri Ramanujacharya Jayanti.
21	11			21- Enters Krittika ($24^h 08^m.0$)	21- Sayana Vyatipata ($11^h 23^m.2$)	21- Gangotpatti.
22	12					
23	13					23- Sita Navami, Trichur Pooram (Kerala).
24	14			24- Saura Jyaishthadi ($13^h 18^m.1$)		24- Minakshi Kolyanam.
25	15					25- Mohini Ekadasi.
26	16	SAURA JYAISHTHA				
27	17					27- Nrisimha Chaturdasi.
28	18				28- Full Moon ($26^h 41^m.4$)	28- Vaisakhi Purnima, Buddha Purnima.
29	19					
30	20					
31	May 21			31- Enters Trop. Gemini ($13^h 29^m.1$)		

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Vrischika 1, $11^h 11^m.5$; Dhanus 3, $17^h 16^m.4$; Makara 5, $27^h 13^m.6$; Kumbha 8, $15^h 45^m.0$; Mina 10, $28^h 15^m.0$; Mesha 13, $14^h 40^m.0$; Vrisha 15, $22^h 29^m.7$; Mithuna 17, $28^h 15^m.4$; Karkata 20, $8^h 36^m.2$; Simha 22, $11^h 54^m.7$; Kanya 24, $14^h 28^m.7$; Tula 26, $16^h 57^m.4$; Vrischika 28, $20^h 30^m.5$; Dhanus 30, $26^h 29^m.2$; Sun enters :- Nirayana Vrisha 25, $11^h 01^m.2$

INDIAN CALENDAR

SAKA ERA 1941

Month of JYAISHTHA (31 days)

Mithuna :Suchi
Summer (Grishma), 2nd Month

(*Nirayana*) 8 Jyaishtha, 5120 Kali Era to (*Nirayana*) 7 Ashadha, 5120 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Wed	May 22	5	16.4	11	56.6	18	37.1	K 4	26	41.1	20	29	13.0	22	9	50.0
2	Thu	23	5	16.1	11	56.7	18	37.5	K 5	28	18.7	21	-	-	23	9	48.3
3	Fri	24	5	15.8	11	56.8	18	38.0	6	-	-	21	7	30.4	24	10	14.0
4	Sat	25	5	15.5	11	56.9	18	38.5	6	6	25.5	22	10	14.7	25	11	00.4
5	Sun	26	5	15.3	11	57.0	18	38.9	7	8	49.6	23	13	13.6	26	11	58.0
6	Mon	27	5	15.0	11	57.1	18	39.4	8	11	16.4	24	16	12.8	27	12	56.4
7	Tue	28	5	14.8	11	57.2	18	39.8	9	13	31.2	25	18	58.0	1	13	45.1
8	Wed	29	5	14.6	11	57.3	18	40.3	K 10	15	21.4	26	21	17.6	2	14	15.1
9	Thu	30	5	14.4	11	57.5	18	40.7	11	16	38.2	27	23	03.4	3	14	19.5
10	Fri	31	5	14.3	11	57.6	18	41.2	12	17	16.8	1	24	11.7	4	13	54.4
11	Sat	June 1	5	14.1	11	57.8	18	41.6	13	17	16.7	2	24	42.4	5	12	58.8
12	Sun	2	5	14.0	11	57.9	18	42.0	14	16	40.1	3	24	38.6	6	11	33.9
13	Mon	3	5	13.9	11	58.1	18	42.5	K 30	15	31.9	4	24	05.3	7	9	42.7
14	Tue	4	5	13.8	11	58.3	18	42.9	S 1	13	57.7	5	23	08.4	8	7	29.2
															(9	28	58.1)
15	Wed	5	5	13.8	11	58.4	18	43.3	2	12	03.5	6	21	54.2	10	26	14.1
16	Thu	6	5	13.7	11	58.6	18	43.7	3	9	55.2	7	20	28.4	11	23	21.4
17	Fri	7	5	13.7	11	58.8	18	44.1	4	7	38.1	8	18	56.1	12	20	23.9
18	Sat	8	5	13.7	11	59.0	18	44.5	S 5	5	16.8	9	17	21.7	13	17	24.9
									(6	26	55.2)						
19	Sun	9	5	13.7	11	59.2	18	44.8	7	24	36.6	10	15	48.9	14	14	27.3
20	Mon	10	5	13.7	11	59.4	18	45.2	8	22	23.8	11	14	20.9	15	11	33.5
21	Tue	11	5	13.8	11	59.6	18	45.5	9	20	19.8	12	13	00.6	16	8	45.7
22	Wed	12	5	13.8	11	59.8	18	45.9	S 10	18	27.3	13	11	50.9	17	6	06.2
															(18	27	37.4)
23	Thu	13	5	13.9	12	00.0	18	46.2	11	16	49.6	14	10	55.0	19	25	21.9
24	Fri	14	5	14.0	12	00.2	18	46.5	12	15	30.3	15	10	16.4	20	23	22.4
25	Sat	15	5	14.1	12	00.4	18	46.8	13	14	33.2	16	9	59.1	21	21	42.0
26	Sun	16	5	14.2	12	00.6	18	47.1	14	14	02.2	17	10	06.7	22	20	23.4
27	Mon	17	5	14.4	12	00.8	18	47.4	S 15	14	00.7	18	10	43.0	23	19	28.9
28	Mon	18	5	14.5	12	01.0	18	47.7	K 1	14	31.1	19	11	50.3	24	18	59.9
29	Wed	19	5	14.7	12	01.3	18	47.9	2	15	34.3	20	13	29.5	25	18	56.4
30	Thu	20	5	14.9	12	01.5	18	48.1	3	17	08.5	21	15	39.1	26	19	16.7
31	Fri	21	5	15.1	12	01.7	18	48.4	K 4	19	08.9	22	18	14.4	27	19	56.7

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Bhadrakali Ekadasi (Punjab).

Uttarayana SAKA ERA 1941

Uttara Gola Month of JYAISHTHA (31 days) Ayanamsa on 1st : $24^0 07' 23''$

(Nirayana) 8 Jyaishtha, 5120 Kali Era to *(Nirayana)* 7 Ashadha, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D					
1	May 22	SAURA JYAISHTHA	CHAANDRA VAISAKHA			
2	23				2- Sayana Vaidhriti ($19^h 07^m.3$)	
3	24					
4	25			4- Enters Rohini ($20^h 26^m.2$)		
5	26					
6	27					
7	28					
8	29					
9	30					9- Apara Ekadasi, Bhadrakali Ekadasi (Punjab).
10	31					
11	June 1					11- Savitri Chaturdasi.
12	2					12- Phalaharini Kalika Puja.
13	3				13- New Moon ($15^h 31^m.9$)	13- Vata Savitri Vrata(Amavasya Paksha).
14	4					
15	5		CHAANDRA JYAISHTHA		15- Sayana Vyatipata ($23^h 42^m.2$)	15- Rambha Tritiya.
16	6					16- Pratap Jayanti (Rajasthan).
17	7					17- Guru Arjan Dev's Martyrdom Day (Sikh).
18	8			18- Enters Mrigasiras ($18^h 13^m.2$)		18- Vindhyavasini Puja, Aranya Shashthi, Jamatri Shashthi (Bengal).
19	9					
20	10					20- Mela Kshir Bhawani (Kashmir) - 2 days.
21	11					
22	12					22- Ganga Dasahara.
23	13					23- Nirjala Ekadasi.
24	14			24- Saura Ashadhadi ($19^h 40^m.1$)		24- Champaka Dvadasi.
25	15					25- Rajas Samkranti (Odisha).
26	16	SAURA ASHADHA				26- Vata Savitri Vrata (Purnima Paksha).
27	17				27- Sayana Vaidhriti ($28^h 24^m.7$)	27- Deva Snana Purnima.
28	18					28- Guru Hargobind's Birthday(J&K) (according to tithi).
29	19					
30	20				27- Full Moon ($14^h 00^m.7$)	
31	June 21			31- Enters Trop. Cancer ($21^h 24^m.2$)		31- Dakshinayana Day.

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters:- Makara 2, $11^h 44^m.2$; Kumbha 4, $23^h 43^m.2$; Mina 7, $12^h 18^m.7$; Mesha 9, $23^h 03^m.4$; Vrisha 12, $6^h 44^m.5$; Mithuna 14, $11^h 39^m.4$; Karkata 16, $14^h 50^m.6$; Simha 18, $17^h 21^m.7$; Kanya 20, $20^h 00^m.0$; Tula 22, $23^h 21^m.0$; Vrischika 24, $28^h 01^m.2$; Dhanus 27, $10^h 43^m.0$; Makara 29, $19^h 59^m.2$;

Sun enters :-Nirayana Mithuna 25, $17^h 38^m.4$

SAKA ERA 1941

Karkata : Nabhas
Rains (Varsa), 1st Month

Month of ASHADHA (31 days)

(*Nirayana*) 8 Ashadha, 5120 Kali Era to (*Nirayana*) 7 Sravana, 5120 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Sat	Jun. 22	5	15.3	12	01.9	18	48.6	K 5	21	27.4	23	21	07.4	1	20	50.4
2	Sun	23	5	15.5	12	02.1	18	48.8	6	23	53.0	24	24	07.4	2	21	49.7
3	Mon	24	5	15.8	12	02.3	18	48.9	7	26	12.8	25	27	01.7	3	22	45.4
4	Tue	25	5	16.1	12	02.5	18	49.1	8	28	13.7	26	-	-	4	23	27.9
5	Wed	26	5	16.3	12	02.8	18	49.3	9	-	-	26	5	37.4	5	23	48.6
6	Thu	27	5	16.6	12	03.0	18	49.4	9	5	44.4	27	7	43.4	6	23	40.7
7	Fri	28	5	16.9	12	03.2	18	49.5	K 10	6	36.5	1	9	11.5	7	22	59.8
8	Sat	29	5	17.2	12	03.4	18	49.6	11	6	45.7	2	9	57.5	8	21	44.3
9	Sun	30	5	17.5	12	03.6	18	49.7	12	6	11.6	3	10	00.9	9	19	55.0
									(13	28	56.6)						
10	Mon	Jul. 1	5	17.9	12	03.8	18	49.7	14	27	05.9	4	9	24.7	10	17	34.9
11	Tue	2	5	18.2	12	04.0	18	49.8	K 30	24	46.2	5	8	14.1	11	14	48.6
12	Wed	3	5	18.5	12	04.2	18	49.8	S 1	22	04.9	6	6	36.2	12	11	41.6
												(7	28	38.7)			
13	Thu	4	5	18.9	12	04.4	18	49.8	2	19	10.1	8	26	30.0	13	8	20.0
															(14	28	50.3)
14	Fri	5	5	19.3	12	04.5	18	49.8	3	16	09.3	9	24	18.0	15	25	18.5
15	Sat	6	5	19.6	12	04.7	18	49.7	4	13	10.1	10	22	10.2	16	21	50.6
16	Sun	7	5	20.0	12	04.9	18	49.7	S 5	10	19.1	11	20	13.6	17	18	31.7
17	Mon	8	5	20.4	12	05.0	18	49.6	6	7	42.4	12	18	33.7	18	15	26.4
18	Tue	9	5	20.8	12	05.2	18	49.5	7	5	25.0	13	17	15.3	19	12	38.2
									(8	27	30.9)						
19	Wed	10	5	21.2	12	05.3	18	49.4	9	26	02.9	14	16	21.7	20	10	10.1
20	Thu	11	5	21.6	12	05.5	18	49.3	S 10	25	02.7	15	15	55.2	21	8	03.7
21	Fri	12	5	22.0	12	05.6	18	49.1	11	24	31.2	16	15	57.0	22	6	20.1
															(23	28	59.6)
22	Sat	13	5	22.4	12	05.7	18	48.9	12	24	28.8	17	16	27.3	24	28	02.2
23	Sun	14	5	22.8	12	05.8	18	48.7	13	24	54.8	18	17	25.8	25	27	27.3
24	Mon	15	5	23.2	12	05.9	18	48.5	14	25	48.5	19	18	51.5	26	27	13.8
25	Tue	16	5	23.7	12	06.0	18	48.3	S 15	27	08.2	20	20	43.2	27	27	20.6
26	Wed	17	5	24.1	12	06.1	18	48.0	K 1	28	51.7	21	22	58.5	1	27	45.6
27	Thu	18	5	24.5	12	06.2	18	47.7	2	-	-	22	25	34.1	2	28	26.3
28	Fri	19	5	24.9	12	06.3	18	47.4	2	6	55.3	23	28	25.1	3	29	18.7
29	Sat	20	5	25.4	12	06.3	18	47.1	3	9	13.8	24	-	-	4	-	-
30	Sun	21	5	25.8	12	06.4	18	46.8	4	11	39.8	24	7	24.8	4	6	17.8
31	Mon	22	5	26.2	12	06.5	18	46.4	K 5	14	04.2	25	10	24.4	5	7	17.1

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1941

Dakshinayana

Uttara Gola

Month of ASHADHA (31 days)

Ayanamsa on 1st : 24° 07′ 29″

(*Nirayana*) 8 Ashadha, 5120 Kali Era to (*Nirayana*) 7 Sravana, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019A.D.					
1	June 22		CHAANDRA JYAISHTHA	1- Enters Ardra ($17^h 18^m.7$)		
2	23					
3	24					
4	25					
5	26					
6	27					
7	28					
8	29					8- Yogini Ekadasi.
9	30	SAURA ASHADHA				
10	July 1				10- Sayana Vyatipata ($14^h 58^m.7$)	
11	2				11- New Moon ($24^h 46^m.2$)	
12	3		CHAANDRA ASHADHA		12- Solar Eclipse (not visible in India).	
13	4					13- Rathayatra, Monoratha Dvitiya Vrata (Bengal).
14	5					
15	6			15- Enters Punarvasu ($16^h 49^m.6$)		
16	7					16- Kumara Shashthi (Vrata).
17	8					17- Vivasvat Saptami.
18	9					18- Kharchi Puja (Tripura).
19	10					19- Mela Sharik Bhagwati (Kashmir).
20	11				20- Mars sets in the west ($12^h 01^m$)	20- Punaryatra.
21	12					21- Harisayani Ekadasi, Ultarath (Odisha), Bahudha Yatra.
22	13				22- Sayana Vaidhriti ($13^h 46^m.4$)	22- Martyr's day (Kashmir).
23	14					
24	15					24- Mela Jwalamukhi (Kashmir).
25	16			25- Saura Sravanadi ($6^h 31^m.1$)	25- Full Moon ($27^h 08^m.2$)	25- Guru Purnima, Vyasa Puja, Ashadhi Purnima.
26	17	SAURA SRAVANA			26- Lunar Eclipse (visible in India).	26- Manasa Puja begins (Bengal).
27	18					
28	19					
29	20			29- Enters Pushya ($16^h 26^m.4$)		
30	21					
31	July 22					31- Nag Panchami (Bengal).

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters:- Kumbha 1, $7^h 39^m.3$; Mina 3, $20^h 19^m.3$; Mesha 6, $7^h 43^m.4$; Vrisha 8, $16^h 02^m.3$; Mithuna 10, $20^h 53^m.3$; Karkata 12, $23^h 09^m.4$; Simha 14, $24^h 18^m.0$; Kanya 16, $25^h 46^m.8$; Tula 18, $28^h 45^m.2$; Vrischika 21, $9^h 53^m.9$; Dhanus 23, $17^h 25^m.8$; Makara 25, $27^h 14^m.9$; Kumbha 28, $14^h 58^m.0$; Mina 30, $27^h 40^m.0$; Sun enters:-Nirayana Karkata 25, $28^h 33^m.6$

SAKA ERA 1941

Simha : Nabhasya
Rains (Varsa), 2nd Month

Month of SRAVANA (31 days)

(*Nirayana*) 8 Sravana, 5120 Kali Era to (*Nirayana*) 7 Bhadra, 5120 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
				h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.																
1	Tue	Jul.	23	5	26.7	12	06.5	18	46.1	K 6	16	16.4	26	13	13.7	6	8	09.2
2	Wed		24	5	27.1	12	06.5	18	45.7	7	18	05.4	27	15	41.9	7	8	46.1
3	Thu		25	5	27.6	12	06.5	18	45.3	8	19	21.3	1	17	38.8	8	9	00.1
4	Fri		26	5	28.0	12	06.5	18	44.8	9	19	56.4	2	18	56.5	9	8	44.6
5	Sat		27	5	28.4	12	06.5	18	44.4	K 10	19	46.2	3	19	30.0	10	7	54.7
6	Sun		28	5	28.9	12	06.5	18	43.9	11	18	49.8	4	19	17.8	11	6	28.0
																(12	28	24.5)
7	Mon		29	5	29.3	12	06.5	18	43.4	12	17	09.2	5	18	21.8	13	25	46.4
8	Tue		30	5	29.7	12	06.4	18	42.9	13	14	49.5	6	16	47.1	14	22	38.1
9	Wed		31	5	30.2	12	06.4	18	42.4	14	11	57.6	7	14	40.7	15	19	05.5
10	Thu	Aug.	1	5	30.6	12	06.4	18	41.8	K 30	8	41.9	8	12	11.5	16	15	15.6
										(S 1	29	11.6)						
11	Fri		2	5	31.0	12	06.3	18	41.3	2	25	36.3	9	9	29.1	17	11	16.0
12	Sat		3	5	31.5	12	06.2	18	40.7	3	22	05.8	10	6	43.7	18	7	14.5
													(11	28	05.5)	(19	27	19.2)
13	Sun		4	5	31.9	12	06.1	18	40.1	4	18	49.2	12	25	43.9	20	23	37.4
14	Mon		5	5	32.3	12	06.0	18	39.5	S 5	15	54.9	13	23	47.5	21	20	15.8
15	Tue		6	5	32.7	12	06.0	18	38.9	6	13	30.4	14	22	23.1	22	17	19.8
16	Wed		7	5	33.1	12	05.8	18	38.2	7	11	41.1	15	21	35.7	23	14	53.3
17	Thu		8	5	33.5	12	05.7	18	37.6	8	10	30.8	16	21	27.4	24	12	58.6
18	Fri		9	5	33.9	12	05.6	18	36.9	9	10	00.4	17	21	58.3	25	11	35.9
19	Sat		10	5	34.3	12	05.4	18	36.2	S 10	10	08.7	18	23	05.6	26	10	43.8
20	Sun		11	5	34.7	12	05.3	18	35.5	11	10	52.5	19	24	45.0	27	10	19.3
21	Mon		12	5	35.1	12	05.1	18	34.7	12	12	06.9	20	26	51.3	1	10	18.8
22	Tue		13	5	35.5	12	05.0	18	34.0	13	13	46.5	21	29	18.7	2	10	38.0
23	Wed		14	5	35.9	12	04.8	18	33.2	14	15	45.7	22	-	-	3	11	12.7
24	Thu		15	5	36.3	12	04.6	18	32.5	S 15	17	59.2	22	8	01.8	4	11	58.9
25	Fri		16	5	36.7	12	04.4	18	31.7	K 1	20	22.0	23	10	55.6	5	12	52.9
26	Sat		17	5	37.0	12	04.2	18	30.9	2	22	48.8	24	13	55.1	6	13	51.1
27	Sun		18	5	37.4	12	04.0	18	30.1	3	25	13.8	25	16	54.7	7	14	49.4
28	Mon		19	5	37.8	12	03.7	18	29.2	4	27	30.3	26	19	48.3	8	15	43.2
29	Tue		20	5	38.1	12	03.5	18	28.4	K 5	29	30.6	27	22	28.5	9	16	27.4
30	Wed		21	5	38.5	12	03.2	18	27.6	6	-	-	1	24	47.2	10	16	56.0
31	Thu		22	5	38.9	12	03.0	18	26.7	K 6	7	06.4	2	26	35.9	11	17	02.6

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Dakshinayana
Uttara Gola

SAKA ERA 1941
Month of SRAVANA (31 days)

Ayanamsa on 1st : 24^0 07$^/$ 34$^{//}$

(Nirayana) 8 Sravana, 5120 Kali Era to *(Nirayana)* 7 Bhadra, 5120 Kali Era

Date	Gergorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D.					
1	July 23	SAURA SRAVANA	CHHAANDRA ASHADHA	1- Enters Trop. Leo (8^h 20^m.4)	1 - Venus sets in the east (14^h 53^m.0)	1- Ker Puja (Tripura).
2	24					
3	25					
4	26				4- Sayana Vyatipata (29^h 11^m.0)	
5	27					
6	28					6- Kamika Ekadasi.
7	29					
8	30					
9	31					9- Chitalagi Amavasya (Odisha), Adi Amavasya (Tamil Nadu), Karkataka Vavu (Kerala).
10	Aug. 1		CHHAANDRA SRAVANA		10- New Moon (8^h 41^m.9)	10- Tilak Commemoration Day.
11	2					
12	3			12- Enters Aslesha (15^h 17^m.9)		12- Madhusrava Tritiya (Teej), Adi Puram (S. India).
13	4					
14	5					14- Naga Panchami.
15	6					
16	7				16- Sayana Vaidhriti (23^h 18^m.6)	16- Goswami Tulasi Das Jayanti.
17	8					
18	9					18- Vara Mahalakshmi Vrata (S. India).
19	10					19- Jhulana Yatrarambha (Pradosa).
20	11					20- Pabitra Ekadasi, Jhulana Yatrarambha (Purvahna).
21	12					
22	13					
23	14					23- Jhulana Yatra Samapanna (Pradosa), Naroli Purnima.
24	15				24- Full Moon (17^h 59^m.2)	24- Raksha Bandhana, Jhulana Yatra Samapanna (Purvahna), Sravani Purnima, Balabhadra Puja(Odisha), Solono (Rakhi Bandhan-Delhi), Avani Avittam (S. India), Rik Upakarma, Independence Day.
25	16			25- Saura Bhadrapadadi (15^h 07^m.6)		
26	17	SAURA BHADRAPADA		26- Enters Magha (13^h 02^m.1)		26- Manasa Puja ends (Bengal), Simhadi(Kerala), Beginning of Kollam Era.
27	18					27- Teejri (Sindhi).
28	19					28- Bahula Chaturthi, Sankashta Chaturthi.
29	20					29- Raksha Panchami (Odisha), Tithi of Sri Madhava Deva (Assam).
30	21				30- Sayana Vyatipata (13^h 59^m.6)	
31	Aug. 22					

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Mesha 2, 15^h 41^m.9; Vrisha 4, 25^h 09^m.2; Mithuna 7, 6^h 55^m.1; Karkata 9, 9^h 14^m.9; Simha 11, 9^h 29^m.1; Kanya 13, 9^h 28^m.2; Tula 15, 11^h 00^m.9; Vrischika 17, 15^h 25^m.7; Dhanus 19, 23^h 05^m.6; Makara 22, 9^h 26^m.4; Kumbha 24, 21^h 27^m.7; Mina 27, 10^h 10^m.1; Mesha 29, 22^h 28^m.5; Sun enters :- Nirayana Simha 26, 13^h 02^m.1.

INDIAN CALENDAR

SAKA ERA 1941

Kanya: Isha

Month of BHADRA (31 days) — Autumn (Sarat), 1st Month

(*Nirayana*) 8 Bhadra, 5120 Kali Era to (*Nirayana*) 7 Asvina, 5120 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi			Nakshatra			Yoga		
									No.	Ending Moment		No.	Ending Moment		No.	Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Fri	Aug. 23	5	39.2	12	02.8	18	25.8	K 7	8	09.2	3	27	47.3	12	16	41.4
2	Sat	24	5	39.6	12	02.5	18	25.0	8	8	32.3	4	28	15.8	13	15	47.3
3	Sun	25	5	39.9	12	02.2	18	24.1	9	8	10.7	5	27	58.7	14	14	17.1
4	Mon	26	5	40.2	12	01.9	18	23.2	K 10	7	02.8	6	26	56.4	15	12	09.6
									(11	29	09.9)						
5	Tue	27	5	40.6	12	01.7	18	22.3	12	26	36.2	7	25	13.0	16	9	26.1
6	Wed	28	5	40.9	12	01.4	18	21.3	13	23	28.6	8	22	54.8	17	6	10.0
															(18	26	26.7)
7	Thu	29	5	41.3	12	01.0	18	20.4	14	19	55.6	9	20	10.8	19	22	23.2
8	Fri	30	5	41.6	12	00.8	18	19.5	K 30	16	07.1	10	17	11.2	20	18	07.7
9	Sat	31	5	41.9	12	00.5	18	18.5	S 1	12	13.8	11	14	07.3	21	13	49.0
10	Sun	Sept. 1	5	42.2	12	00.2	18	17.6	2	8	26.7	12	11	10.7	22	9	36.2
									(3	28	56.6)				(23	29	38.2)
11	Mon	2	5	42.6	12	00.0	18	16.6	4	25	54.0	13	8	32.7	24	26	03.3
12	Tue	3	5	42.9	11	59.5	18	15.6	S 5	23	27.8	14	6	23.9	25	22	58.5
												(15	28	53.3)			
13	Wed	4	5	43.2	11	59.2	18	14.7	6	21	44.9	16	28	07.3	26	20	29.0
14	Thu	5	5	43.5	11	58.9	18	13.7	7	20	49.8	17	28	08.9	27	18	37.7
15	Fri	6	5	43.8	11	58.5	18	12.7	8	20	43.2	18	28	57.5	1	17	25.2
16	Sat	7	5	44.1	11	58.2	18	11.7	9	21	22.4	19	-	-	2	16	49.0
17	Sun	8	5	44.5	11	57.8	18	10.7	S 10	22	41.4	19	6	29.0	3	16	44.6
18	Mon	9	5	44.8	11	57.5	18	09.7	11	24	31.2	20	8	35.9	4	17	05.6
19	Tue	10	5	45.1	11	57.1	18	08.7	12	26	42.7	21	11	09.2	5	17	45.0
20	Wed	11	5	45.4	11	56.8	18	07.7	13	29	06.7	22	13	59.4	6	18	36.0
21	Thu	12	5	45.7	11	56.4	18	06.7	14	-	-	23	16	58.1	7	19	32.6
22	Fri	13	5	46.0	11	56.1	18	05.7	14	7	35.4	24	19	58.5	8	20	30.0
23	Sat	14	5	46.3	11	55.7	18	04.7	S 15	10	02.8	25	22	55.3	9	21	24.5
24	Sun	15	5	46.6	11	55.4	18	03.6	K 1	12	24.1	26	25	44.4	10	22	13.0
25	Mon	16	5	46.9	11	55.0	18	02.6	2	14	35.5	27	28	22.0	11	22	52.7
26	Tue	17	5	47.2	11	54.7	18	01.6	3	16	33.0	1	-	-	12	23	20.6
27	Wed	18	5	47.5	11	54.3	18	00.6	4	18	11.6	1	6	43.8	13	23	33.2
28	Thu	19	5	47.8	11	53.9	17	59.6	K 5	19	26.7	2	8	44.9	14	23	26.3
29	Fri	20	5	48.1	11	53.6	17	58.5	6	20	11.6	3	10	19.6	15	22	55.5
30	Sat	21	5	48.4	11	53.2	17	57.5	7	20	21.0	4	11	21.7	16	21	56.3
31	Sun	22	5	48.7	11	52.8	17	56.5	K 8	19	50.3	5	11	46.1	17	20	25.2

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1941

Dakshinayana

Uttara Gola

Month of BHADRA (31 days)

Ayanamsa on 1st : $24^{0}\,07^{/}\,38^{//}$

(*Nirayana*) 8 Bhadra, 5120 Kali Era to (*Nirayana)* 7 Asvina, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D.					
1	Aug. 23	SAURA BHADRAPADA	CHAANDRA SRAVANA	1- Enters Trop. Virgo ($15^{h}32^{m}.0$)		1- Janmashtami (Smarta), Vadi Thadri (Sindhi), Sri Krishna Jayanti (T.N., Assam & Kerala), Durvashtami (except Bengal).
2	24					2- Janmashtami(Vaishnava), Gokulashtami (Nandotsava), Sri Jayanti (Ramanuja), Jayanti Yoga.
3	25					
4	26					4- Paryusana Parvarambha(Chaturthi Paksha-Jain), Aja Ekadasi (Smarta).
5	27					5- Paryusana Parvarambha (Panchami Paksha-Jain), Ekadasi (Vaishnava & Vidhava).
6	28					6- Kailas Yatra- 2 days.
7	29					7- Pithori, Aghora Chaturdasi.
8	30				8- New Moon ($16^{h}\,07^{m}.1$)	8- Kusotpatini, Jain Fstival, Saptapuri Amavasya (Odisha).
9	31		CHAANDRA BHADRAPADA	9- Enters PurvaPhalguni ($9^{h}\,00^{m}.3$)		
10	Sept. 1					10- Tithi of Sri Sankara Deva (Assam), Haritalika Gauri Tritiya.
11	2				11- Sayana Vaidhriti ($13^{h}\,25^{m}.8$)	11- Samvatsari (Chaturthi Paksha - Jain), Ganesha Chaturthi,Haritalika Chaturthi,Vinayaka Chaturthi(TN).
12	3					12- Samvatsari (Panchami Paksha-Jain), Keil Muhurth (Coorg), Rishi Panchami,Mela Pat-3 days(J&K).
13	4					13- Surya Shashthi.
14	5					
15	6					15- Mahalakshmi Vratarambha. Durvashtami(Bengal), Radhashtami.
16	7					
17	8				17- Venus rises in the west ($28^{h}\,39^{m}.0$)	
18	9					18- Dol Gyaras (MP), Heikru Hidongba (Manipur), Parsvaparivartani Ekadasi.
19	10					19- First Onam Day, Vamana Jayanti, Sravana Dvadasi,Sakrotthana.
20	11					20- Onam or Thiru Onam Day (Kerala).
21	12					21- Ananta Chaturdasi, Third Onam Day.
22	13			22- Enters U. Phalguni ($26^{h}54^{m}.2$)		22- Indra Purnima, Fourth Onam Day, Sri Narayana Guru Deva's Birthday (Kerala).
23	14				23- Full Moon ($10^{h}\,02^{m}.8$)	23- Pitri Paksha Tarpana begins, Yaju Upakarma.
24	15				24- Sayana Vyatipata ($19^{h}\,14^{m}.8$)	24- Gayatri Japam.
25	16			25- Saura Asvinadi ($15^{h}25^{m}.7$)		
26	17					26- Visvakarma Puja.
27	18	SAURA ASVINA				
28	19					
29	20					
30	21					30- Mahalakshmi Vrata Samapanna, Samadhi day of Narayana Guru (Kerala).
31	Sept. 22					

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters : Vrisha 1, $8^{h}\,57^{m}.6$; Mithuna 3, $16^{h}\,12^{m}.9$;Karkata 5, $19^{h}\,42^{m}.3$;Simha 7, $20^{h}\,10^{m}.8$;Kanya 9, $19^{h}\,22^{m}.0$; Tula 11, $19^{h}\,24^{m}.2$;Vrischika 13, $22^{h}\,14^{m}.5$;Dhanus 15, $28^{h}\,57^{m}.5$;Makara 18,$15^{h}\,12^{m}.1$;Kumbha 20, $27^{h}\,28^{m}.2$;Mina 23, $16^{h}\,11^{m}.7$; Mesha 25, $28^{h}\,22^{m}.0$;Vrisha 28,$15^{h}\,11^{m}.3$;Mithuna 30, $23^{h}\,38^{m}.9$;Sun enters :-Nirayana Kanya 26, $13^{h}\,02^{m}.6$.

SAKA ERA 1941

Tula : Urja

Month of ASVINA (30 days) Autumn (Sarat), 2nd Month

(*Nirayana*) 8 Asvina, 5120 Kali Era to (*Nirayana*) 7 Kartika, 5120 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Mon	Sep. 23	5	49.0	11	52.5	17	55.5	K 9	18	37.3	6	11	29.4	18	18	20.3
2	Tue	24	5	49.4	11	52.2	17	54.5	K 10	16	42.4	7	10	30.9	19	15	41.4
3	Wed	25	5	49.7	11	51.8	17	53.4	11	14	08.9	8	8	52.7	20	12	30.8
4	Thu	26	5	50.0	11	51.5	17	52.4	12	11	02.8	9	6	40.0	21	8	52.8
												(10	28	00.7)	(22	28	53.4)
5	Fri	27	5	50.3	11	51.1	17	51.4	13	7	32.0	11	25	04.4	23	24	40.3
									(14	27	46.3)						
6	Sat	28	5	50.7	11	50.8	17	50.4	K 30	23	56.4	12	22	02.4	24	20	22.3
7	Sun	29	5	51.0	11	50.5	17	49.4	S 1	20	13.7	13	19	06.7	25	16	08.6
8	Mon	30	5	51.3	11	50.1	17	48.4	2	16	49.7	14	16	29.0	26	12	08.4
9	Tue	Oct. 1	5	51.7	11	49.8	17	47.5	3	13	55.2	15	14	20.8	27	8	30.7
															(1	29	23.4)
10	Wed	2	5	52.0	11	49.5	17	46.5	4	11	40.1	16	12	52.0	2	26	52.8
11	Thu	3	5	52.4	11	49.2	17	45.5	S 5	10	11.9	17	12	10.1	3	25	02.5
12	Fri	4	5	52.7	11	48.9	17	44.5	6	9	35.3	18	12	19.0	4	23	53.4
13	Sat	5	5	53.1	11	48.6	17	43.6	7	9	50.9	19	13	18.4	5	23	23.4
14	Sun	6	5	53.4	11	48.3	17	42.6	8	10	54.5	20	15	03.4	6	23	27.2
15	Mon	7	5	53.8	11	48.0	17	41.6	9	12	38.1	21	17	25.1	7	23	57.2
16	Tue	8	5	54.2	11	47.7	17	40.7	S 10	14	50.3	22	20	12.0	8	24	44.7
17	Wed	9	5	54.6	11	47.4	17	39.8	11	17	18.8	23	23	11.9	9	25	40.9
18	Thu	10	5	54.9	11	47.1	17	38.8	12	19	51.9	24	26	13.9	10	26	37.9
19	Fri	11	5	55.3	11	46.9	17	37.9	13	22	20.1	25	29	09.4	11	27	29.6
20	Sat	12	5	55.7	11	46.6	17	37.0	14	24	36.8	26	-	-	12	28	11.8
21	Sun	13	5	56.1	11	46.3	17	36.1	S 15	26	37.9	26	7	52.6	13	28	41.8
22	Mon	14	5	56.5	11	46.1	17	35.2	K 1	28	21.1	27	10	20.2	14	28	58.1
23	Tue	15	5	56.9	11	45.9	17	34.4	2	29	45.1	1	12	30.2	15	28	59.6
24	Wed	16	5	57.4	11	45.6	17	33.5	3	-	-	2	14	21.2	16	28	45.3
25	Thu	17	5	57.8	11	45.4	17	32.7	3	6	48.4	3	15	51.6	17	28	13.5
26	Fri	18	5	58.2	11	45.2	17	31.8	4	7	29.0	4	16	59.0	18	27	22.1
27	Sat	19	5	58.7	11	45.0	17	31.0	K 5	7	43.9	5	17	40.3	19	26	08.6
28	Sun	20	5	59.1	11	44.9	17	30.2	6	7	30.1	6	17	52.2	20	24	30.6
29	Mon	21	5	59.6	11	44.7	17	29.4	7	6	44.6	7	17	32.0	21	22	26.2
									(8	29	52.5)						
30	Tue	22	6	00.1	11	44.5	17	28.6	K 9	27	32.9	8	16	38.5	22	19	54.6

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Dakshinayana
Dakshina Gola

SAKA ERA 1941
Month of ASVINA (30 days)

Ayanamsa on 1st : $24^{0} 07^{/} 41^{//}$

(*Nirayana*) 8 Asvina, 5120 Kali Era to (*Nirayana*) 7 Kartika, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D.					
1	Sept. 23	SAURA ASVINA	CHAANDRA BHADRAPADA	1- Enters Trop. Libra ($13^h 20^m.2$)		1- Matri Navami, Jalavisuva Day
2	24					
3	25					3- Indira Ekadasi.
4	26					4- Magha Trayodasi (Trayodasi after $11^h 02^m.8$).
5	27			5- Enters Hasta ($18^h 26^m.6$)		
6	28				6- New Moon ($23^h 56^m.4$) 6- Sayana Vaidhriti ($8^h 11^m.0$)	6- Mahalaya Amavasya, Sarvapitri Amavasya (Odisha), Tarpana Loiba (Manipur).
7	29		CHAANDRA ASVINA			7- Saradiya Navaratrarambha, Samaveda Upakarma, Maharaja Agrasen's Jayanti.
8	30					
9	Oct. 1					
10	2					10- Mahatma Gandhi's Birthday, UpangaLalitaVrata(Lalita Panchami).
11	3					
12	4					12- Sarasvati Avahana.
13	5					13- Durga Puja begins (Saptami), Oli begins(Jain).
14	6					14- Mahashtami.
15	7					15- Mahanavami, Sarasvati Visarjana, Ayudha Puja.
16	8					16- Vijaya Dasami (Dussehara or Dasahara),Vijaya Dasami (Bengal & Kerala), Sri Madhavacharya Jayanti.
17	9					17- Papankusa (Pasankusa) Ekadasi, Bharat Milap.
18	10				18- Sayana Vyatipata ($23^h 38^m.9$)	
19	11			19- Enters Chitra ($7^h 25^m.6$)		
20	12				20- Mars rises in the east ($28^h 19^m$)	
21	13				21- Full Moon ($26^h 37^m.9$)	21- Kojagori Lakshmi Puja (Bengal), Kumara Purnima(Odisha), Oli ends (Jain), Sarat Purnima, Maharshi Valmiki's Birthday(according to tithi) Kojagar (Lakshmindra Puja).
22	14					
23	15					
24	16			24- Saura Kartikadi ($3^h 47^m.2$)		
25	17					25- Karaka Chaturthi (Karwa Chouth), Dasaratha Chaturthi.
26	18	SAURA KARTIKA				26-Kaveri Samkramana Snana.
27	19					
28	20					
29	21					29- Ahoyi Ashtami, Karashtami, Ahoyi Ashtami (Punjab).
30	Oct. 22					

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Karkata 1, $28^h 49^m.4$;Simha 4,$6^h 40^m.0$; Kanya 6, $6^h 19^m.0$; Tula 7, $29^h 44^m.7$; Vrischika 10, $7^h 10^m.0$; Dhanus 12, $12^h 19^m.0$; Makara 14, $21^h 35^m.8$; Kumbha 17, $9^h 41^m.0$; Mina 19, $22^h 26^m.5$; Mesha 22, $10^h 20^m.2$; Vrisha 24, $20^h 45^m.8$; Mithuna 26, $29^h 23^m.1$; Karkata 29, $11^h 40^m.2$; Sun enters :- Nirayana Tula 25, $25^h 02^m.8$.

SAKA ERA 1941

Vrischika : Sahas
Hemanta, 1st Month

Month of KARTIKA (30 days)

(*Nirayana*) 8 Kartika, 5120 Kali Era to (*Nirayana*) 7 Agrahayana, 5120 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi No.		Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2019 A.D.																	
1	Wed	Oct.	23	6	00.5	11	44.4	17	27.8	K	10	25	09.1	9	15	12.6	23	16	56.9
2	Thu		24	6	01.0	11	44.2	17	27.1		11	22	18.6	10	13	17.8	24	13	35.8
3	Fri		25	6	01.5	11	44.0	17	26.4		12	19	08.3	11	11	00.1	25	9	55.9
4	Sat		26	6	02.0	11	44.0	17	25.6		13	15	46.6	12	8	27.3	26	6	03.2
														(13	29	49.2)	(27	26	05.1)
5	Sun		27	6	02.5	11	43.9	17	24.9		14	12	23.2	14	27	16.5	1	22	09.9
6	Mon		28	6	03.0	11	43.8	17	24.3	K	30	9	08.5	15	25	00.3	2	18	26.0
7	Tue		29	6	03.6	11	43.7	17	23.6	S	1	6	13.3	16	23	11.3	3	15	01.8
											(2	27	48.0)						
8	Wed		30	6	04.1	11	43.7	17	22.9		3	26	01.7	17	21	59.1	4	12	05.0
9	Thu		31	6	04.6	11	43.6	17	22.3		4	25	01.5	18	21	31.2	5	9	41.8
10	Fri	Nov.	1	6	05.2	11	43.6	17	21.7	S	5	24	51.3	19	21	51.9	6	7	56.6
11	Sat		2	6	05.7	11	43.6	17	21.1		6	25	31.2	20	23	01.3	7	6	50.9
12	Sun		3	6	06.3	11	43.5	17	20.5		7	26	56.3	21	24	54.8	8	6	23.1
13	Mon		4	6	06.9	11	43.5	17	20.0		8	28	57.3	22	27	23.3	9	6	28.5
14	Tue		5	6	07.5	11	43.6	17	19.4		9	-	-	23	-	-	10	6	59.7
15	Wed		6	6	08.0	11	43.6	17	18.9		9	7	21.6	23	6	14.6	11	7	47.3
16	Thu		7	6	08.6	11	43.6	17	18.4	S	10	9	55.0	24	9	15.1	12	8	41.5
17	Fri		8	6	09.2	11	43.7	17	17.9		11	12	24.5	25	12	12.2	13	9	33.1
18	Sat		9	6	09.8	11	43.7	17	17.5		12	14	39.6	26	14	55.5	14	10	14.5
19	Sun		10	6	10.5	11	43.8	17	17.0		13	16	33.2	27	17	18.4	15	10	40.5
20	Mon		11	6	11.1	11	43.9	17	16.6		14	18	01.8	1	19	17.3	16	10	47.9
21	Tue		12	6	11.7	11	44.0	17	16.2	S	15	19	04.4	2	20	51.1	17	10	35.6
22	Wed		13	6	12.3	11	44.2	17	15.8	K	1	19	41.7	3	22	00.7	18	10	03.6
23	Thu		14	6	13.0	11	44.3	17	15.5		2	19	55.1	4	22	47.2	19	9	12.7
24	Fri		15	6	13.6	11	44.5	17	15.2		3	19	45.9	5	23	12.0	20	8	03.9
25	Sat		16	6	14.3	11	44.7	17	14.9		4	19	15.1	6	23	15.7	21	6	37.9
																	(22	28	55.1)
26	Sun		17	6	14.9	11	44.8	17	14.6	K	5	18	23.1	7	22	58.6	23	26	55.5
27	Mon		18	6	15.6	11	45.0	17	14.3		6	17	09.9	8	22	20.6	24	24	39.1
28	Tue		19	6	16.3	11	45.2	17	14.1		7	15	35.6	9	21	22.4	25	22	06.0
29	Wed		20	6	16.9	11	45.5	17	13.9		8	13	41.3	10	20	04.4	26	19	17.1
30	Thu		21	6	17.6	11	45.7	17	13.7	K	9	11	28.8	11	18	29.3	27	16	14.0

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Dakshinayan | SAKA ERA 1941
Dakshina Gola | Month of KARTIKA (30 days) | Ayanamsa on 1st : $24^{0} 07^{\prime} 44^{\prime\prime}$

(*Nirayana*) 8 Kartika, 5120 Kali Era to (*Nirayana*) 7 Agrahayana, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D.					
1	Oct. 23	SAURA KARTIKA	CHAANDRA ASVINA	1- Enters Tropical Scorpio ($22^h 49^m.7$)	1- Sayana Vaidhriti ($24^h 48^m.5$)	
2	24			2- Enters Svati ($17^h 59^m.8$)		2- Rama Ekadasi.
3	25					3- Govatsa Dvadasi, Dhana Trayodasi.
4	26					4- Kali Chaturdasi.
5	27					5- Dipavali(S.India), Hanumajjanma (N. India)(Purvarunodaya), Naraka Chaturdasi (Purvarunodaya), Kali Puja,Dipavali, Lakshmi Puja, Kaumudi Dipam, Lakshmi Dipam, Kedar Gauri Vrata (S. India), Mahavira Nirvana(Jain).
6	28				6- New Moon ($9^h 08^m.5$)	6- Kartika Sukladi, Govardhana Puja, Bali Puja, Annakuta.
7	29		CHAANDRA KARTIKA			7- Yama Dvitiya, Bhratri Dvitiya (Bengal), Dwat Puja (Bihar), Viswakarma Day, Tikka Ceremony.
8	30					
9	31					
10	Nov. 1					10- Martyrdom day of Bhagat Kanwar Ram (Sindhi),Jnana Panchami(Jain).
11	2					11- Pratihara Shashthi or Surya Shashthi (Chhat -Bihar).
12	3					
13	4				13- Sayana Vyatipata ($28^h 03^m.6$)	13- Gopashtami or Goshthashtami, Trivandrum Arat (Kerala).
14	5					14- Jagaddhatri Puja, Akshaya Navami
15	6			15- Enters Visakha ($26^h 04^m.4$)	13- Jupiter enters Dhanus ($29^h 17^m.4$)	
16	7					
17	8					17- Utthana or Deva Probodhani Ekadasi, Tulasi Vivaha.
18	9					
19	10					19- Vaikuntha Chaturdasi (Pradosa).
20	11					20- Rasayatra (Smarta),Vaikuntha Chaturdasi.
21	12				21- Full Moon ($19^h 04^m.4$)	21- Rasayatra(Vaishnava),Pushkar Fair (Ajmer),Kartiki Purnima,Rathayatra (Jain),Tripurotsava, Guru Nanak's Birthday (Sikh) (according to tithi).
22	13					
23	14					23- Children's Day (Nehru's Birthday).
24	15			24- Saura Margasirshadi ($27^h 53^m.8$)		
25	16	SAURA MARGASIRSHA				
26	17					26- Death anniversary of Lala Lajpat Rai, Kartika Puja.
27	18				27- Sayana Vaidhriti ($11^h 12^m.0$)	
28	19					28- Kalashtami.
29	20			29- Enters Anuradha ($8^h 11^m.5$)		29- Birthday celebration of Prof. Ram Panjwani (Sindhi), Prathamashtami (Odisha),Vaikkatashtami (Kerala).
30	Nov. 21					

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters : Simha 1,$15^h 12^m.6$;Kanya 3,$16^h 22^m.9$;Tula 5,$16^h 31^m.5$;Vrischika 7,$17^h 35^m.4$;Dhanus 9,$21^h 31^m.2$; Makara 11,$29^h 25^m.8$; Kumbha 14, $16^h 46^m.9$;Mina 16, $29^h 28^m.9$; Mesha 19,$17^h 18^m.4$;Vrisha 21, $27^h 10^m.7$; Mithuna 24, $11^h 02^m.2$;Karkata 26, $17^h 04^m.9$;Simha 28, $21^h 22^m.4$;Kanya 30,$24^h 03^m.2$; Sun enters :- Nirayana Vrischika 25, $24^h 51^m.3$.

INDIAN CALENDAR

SAKA ERA 1941

Dhanus : Sahasya
Hemanta, 2nd Month

Month of AGRAHAYANA (30 days)

(*Nirayana*) 8 Agrahayana, 5120 Kali Era to (*Nirayana*) 7 Pausha, 5120 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Fri	Nov. 22	6	18.3	11	46.0	17	13.5	K 10	9	01.5	12	16	40.8	1	12	59.7
2	Sat	23	6	19.0	11	46.2	17	13.4	11	6	24.2	13	14	44.6	2	9	33.1
									(12	27	43.2)				(3	30	14.3)
3	Sun	24	6	19.7	11	46.5	17	13.3	13	25	06.0	14	12	47.4	4	26	54.2
4	Mon	25	6	20.3	11	46.8	17	13.2	14	22	40.6	15	10	57.2	5	23	44.2
5	Tue	26	6	21.0	11	47.0	17	13.1	K 30	20	35.7	16	9	22.6	6	20	51.0
6	Wed	27	6	21.7	11	47.4	17	13.1	S 1	18	59.3	17	8	12.1	7	18	20.6
7	Thu	28	6	22.4	11	47.8	17	13.1	2	17	58.9	18	7	33.7	8	16	18.4
8	Fri	29	6	23.1	11	48.1	17	13.1	3	17	39.9	19	7	33.6	9	14	48.5
9	Sat	30	6	23.8	11	48.4	17	13.1	4	18	05.0	20	8	15.5	10	13	52.5
10	Sun	Dec. 1	6	24.5	11	48.8	17	13.2	S 5	19	13.4	21	9	39.3	11	13	29.9
11	Mon	2	6	25.1	11	49.2	17	13.3	6	20	59.6	22	11	42.9	12	13	37.0
12	Tue	3	6	25.8	11	49.6	17	13.4	7	23	14.2	23	14	16.5	13	14	07.7
13	Wed	4	6	26.5	11	50.0	17	13.5	8	25	44.3	24	17	09.1	14	14	53.3
14	Thu	5	6	27.2	11	50.4	17	13.6	9	28	15.6	25	20	07.2	15	15	44.0
15	Fri	6	6	27.8	11	50.8	17	13.8	S 10	-	-	26	22	57.2	16	16	30.1
16	Sat	7	6	28.5	11	51.2	17	14.0	S 10	6	34.4	27	25	27.6	17	17	02.7
17	Sun	8	6	29.1	11	51.6	17	14.2	11	8	29.6	1	27	30.2	18	17	15.2
18	Mon	9	6	29.8	11	52.1	17	14.5	12	9	53.6	2	29	00.4	19	17	03.1
19	Tue	10	6	30.4	11	52.5	17	14.7	13	10	43.9	3	29	57.1	20	16	24.5
20	Wed	11	6	31.1	11	53.0	17	15.0	14	10	59.2	4	30	21.9	21	15	19.7
21	Thu	12	6	31.7	11	53.4	17	15.3	S 15	10	42.2	5	30	18.3	22	13	50.3
22	Fri	13	6	32.3	11	53.9	17	15.7	K 1	9	56.8	6	29	50.5	23	11	59.0
23	Sat	14	6	32.9	11	54.4	17	16.0	2	8	47.3	7	29	03.1	24	9	49.1
24	Sun	15	6	33.5	11	54.8	17	16.4	3	7	18.4	8	28	00.6	25	7	24.1
									(4	29	34.6)				(26	28	47.1)
25	Mon	16	6	34.1	11	55.3	17	16.8	K 5	27	39.9	9	26	47.0	27	26	01.3
26	Tue	17	6	34.6	11	55.8	17	17.2	6	25	37.6	10	25	25.9	1	23	09.2
27	Wed	18	6	35.2	11	56.3	17	17.6	7	23	31.1	11	24	00.5	2	20	13.4
28	Thu	19	6	35.7	11	56.8	17	18.0	8	21	23.1	12	22	33.8	3	17	16.1
29	Fri	20	6	36.3	11	57.3	17	18.5	9	19	16.8	13	21	08.8	4	14	19.6
30	Sat	21	6	36.8	11	57.8	17	19.0	K 10	17	15.4	14	19	48.9	5	11	26.3

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Dakshinayana — SAKA ERA 1941

Dakshina Gola — Month of AGRAHAYANA (30 days) — Ayanamsa on 1st : $24^0 07^{/} 48^{//}$

(*Nirayana*) 8 Agrahayana, 5120 Kali Era to (*Nirayana*) 7 Pausha, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D.					
1	Nov. 22	SAURA MARGASIRSHA	CHAANDRA KARTIKA	1- Enters Trop. Sagittarius ($20^h 28^m.9$)		1- Utpanna Ekadasi (Smarta).
2	23					2- Ekadasi (Vaishnava & Vidhava), Trisprisha Mahadvadasi.
3	24					3- Guru Tegh Bahadur's Martyrdom Day.
4	25					
5	26				5- New Moon ($20^h 35^m.7$)	
6	27		CHAANDRA MARGASIRSHA			
7	28					
8	29					
9	30				9- Sayana Vyatipata ($11^h 07^m.6$)	
10	Dec. 1					
11	2					11- Guha Shashthi, Subrahmanya Shashthi (S. India), Champa Shashthi(Maharashtra), Mulakrupini Shashthi (Bengal).
12	3			12- Enters Jyeshtha ($12^h 23^m.7$)		12- Mitra Saptami.
13	4					
14	5					
15	6					
16	7					
17	8					17- Mauna Ekadasi (Jain), Mokshada Ekadasi, Gita Jayanti.
18	9					18- Akhanda Dvadasi, Bharani Dipam.
19	10					19- Krittika Dipam.
20	11					20- Sri Datta Jayanti (Maharashtra), Dattatreya Jayanti.
21	12				21- Full Moon ($10^h 42^m.2$)	21- Huthri - 3 days (Coorg), Margi Purnima.
	13					
22	14				22- Sayana Vaidhriti ($20^h 16^m.9$)	
23						
24	15			24- Saura Paushadi ($18^h 40^m.4$)	24- Jupiter sets in the west ($29^h 57^m$)	
25	16			25- Enters Mula ($15^h 27^m.8$)		
26	17	SAURA PAUSHA				
27	18					
28	19					28- Ashtaka (Pupashtaka).
29	20					
30	Dec. 21					30- Birthday of Parsvanatha (Jain).

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Tula 2, $25^h 45^m.6$; Vrischika 4, $27^h 44^m.3$; Dhanus 7, $7^h 33^m.7$; Makara 9, $14^h 32^m.7$; Kumbha 11, $24^h 56^m.5$; Mina 14, $13^h 22^m.9$; Mesha 16, $25^h 27^m.6$; Vrisha 18, $11^h 17^m.6$; Mithuna 21, $18^h 23^m.4$; Karkata 23, $23^h 16^m.5$; Simha 25, $26^h 47^m.0$; Kanya 27, $29^h 38^m.8$; Tula 30, $8^h 28^m.0$; Sun enters :- Nirayana Dhanus 25, $15^h 27^m.8$.

INDIAN CALENDAR

SAKA ERA 1941

Makara : Tapas
Winter (Sisira), 1st Month

Month of PAUSHA (30 days)

(*Nirayana*) 8 Pausha, 5120 Kali Era to (*Nirayana*) 7 Magha, 5120 Kali Era

Date	Week Day	Gregorian Date	Sunrise		Apparent Noon		Sunset		Tithi No.	Tithi Ending Moment		Nakshatra No.	Nakshatra Ending Moment		Yoga No.	Yoga Ending Moment	
			h	m	h	m	h	m		h	m		h	m		h	m
		2019 A.D.															
1	Sun	Dec. 22	6	37.3	11	58.3	17	19.5	K 11	15	22.4	15	18	37.7	6	8	39.0
															(7	30	00.6)
2	Mon	23	6	37.8	11	58.8	17	20.0	12	13	42.0	16	17	39.6	8	27	34.6
3	Tue	24	6	38.3	11	59.3	17	20.5	13	12	18.8	17	16	59.1	9	25	24.5
4	Wed	25	6	38.7	11	59.8	17	21.1	14	11	17.6	18	16	41.1	10	23	33.7
5	Thu	26	6	39.2	12	00.3	17	21.6	K 30	10	43.1	19	16	50.1	11	22	05.6
6	Fri	27	6	39.6	12	00.8	17	22.2	S 1	10	39.7	20	17	30.0	12	21	02.7
7	Sat	28	6	40.0	12	01.3	17	22.8	2	11	10.2	21	18	43.1	13	20	26.4
8	Sun	29	6	40.4	12	01.8	17	23.4	3	12	15.9	22	20	29.7	14	20	16.4
9	Mon	30	6	40.7	12	02.3	17	24.0	4	13	54.8	23	22	46.6	15	20	30.4
10	Tue	31	6	41.1	12	02.7	17	24.6	S 5	16	01.7	24	25	27.6	16	21	03.8
		2020 A.D.															
11	Wed	Jan. 1	6	41.4	12	03.2	17	25.3	6	18	27.6	25	28	22.7	17	21	49.8
12	Thu	2	6	41.7	12	03.7	17	25.9	7	21	00.6	26	-	-	18	22	39.8
13	Fri	3	6	42.0	12	04.1	17	26.6	8	23	26.8	26	7	19.8	19	23	24.1
14	Sat	4	6	42.3	12	04.6	17	27.2	9	25	32.8	27	10	05.4	20	23	53.5
15	Sun	5	6	42.5	12	05.0	17	27.9	S 10	27	07.3	1	12	27.2	21	23	59.5
16	Mon	6	6	42.7	12	05.6	17	28.6	11	28	02.5	2	14	15.4	22	23	37.2
17	Tue	7	6	42.9	12	06.0	17	29.3	12	28	14.8	3	15	23.9	23	22	42.1
18	Wed	8	6	43.1	12	06.4	17	30.0	13	27	44.4	4	15	50.8	24	21	13.8
19	Thu	9	6	43.3	12	06.8	17	30.6	14	26	34.7	5	15	37.6	25	19	13.9
20	Fri	10	6	43.4	12	07.2	17	31.3	S 15	24	51.3	6	14	48.5	26	16	45.8
21	Sat	11	6	43.5	12	07.6	17	32.0	K 1	22	41.2	7	13	30.0	27	13	54.4
22	Sun	12	6	43.6	12	08.0	17	32.8	2	20	12.3	8	11	49.6	1	10	45.3
23	Mon	13	6	43.6	12	08.4	17	33.5	3	17	32.6	9	9	55.3	2	7	24.6
															(3	27	58.4)
24	Tue	14	6	43.7	12	08.7	17	34.2	4	14	49.7	10	7	55.2	4	24	32.6
												(11	29	56.8)			
25	Wed	15	6	43.7	12	09.1	17	34.9	K 5	12	10.7	12	28	06.8	5	21	12.3
26	Thu	16	6	43.7	12	09.6	17	35.6	6	9	41.8	13	26	30.6	6	18	02.1
27	Fri	17	6	43.6	12	10.0	17	36.3	7	7	28.2	14	25	12.6	7	15	05.5
									(8	29	33.7)						
28	Sat	18	6	43.6	12	10.2	17	37.0	9	28	01.0	15	24	15.6	8	12	24.9
29	Sun	19	6	43.5	12	10.5	17	37.8	K 10	26	51.6	16	23	41.2	9	10	02.2
30	Mon	20	6	43.4	12	10.8	17	38.5	K 11	26	06.2	17	23	30.3	10	7	58.0
															(11	30	12.9)

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Uttarayana | SAKA ERA 1941
Dakshina Gola | Month of PAUSHA (30 days) | Ayanamsa on 1st : 24° 07′ 53″

(*Nirayana*) 8 Pausha, 5120 Kali Era to (*Nirayana*) 7 Magha, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2019 A.D.					
1	Dec. 22	SAURA PAUSHA	CHAANDRA MARGASHIRSHA	1- Enters Tropical Capricornus ($9^h 49^m.4$)		1- Uttarayana day, Saphala Ekadasi.
2	23					
3	24					
4	25				4- Sayana Vyatipata ($20^h 56^m.8$)	4- Birthday of Sadhu T. L. Vaswani (Sindhi), Vakula Amavasya (Odisha).
5	26				5- New Moon ($10^h 43^m.1$)	5- Jor Mela- 3 days (Punjab).
6	27		CHAANDRA PAUSHA		5- Solar Eclipse (visible in India)	
7	28					
8	29			8- Enters Purvashadha ($17^h 36^m.1$)		
9	30					
10	31					
	2020 A.D.					
11	Jan. 1					
12	2					12- Guru Govind Singh's Birthday (according to tithi).
13	3					
14	4					
15	5					15- Samba Dasami (Odisha).
16	6					16- Putrada ekadasi, Vaikuntha Ekadasi (S India).
17	7					
18	8				18- Jupiter rises in the East ($30^h 33^m$)	
19	9				18- Sayana Vaidhriti ($7^h 19^m.0$)	
20	10				20- Full Moon ($24^h 51^m.3$)	20- Arudra Darshanam (Purvarunodaya) (S. India), Paushi Purnima, Pushyabhisheka Yatra.
21	11			21- Enters Uttarashadha ($19^h 35^m.5$)		
22	12					
23	13			23- Saura Maghadi ($29^h 20^m.3$)		23- Lohri (Punjab, J&K), Ganesha Sankashta Chaturthi.
24	14					24- Bhogi (S. India), Birthday of Sant Paramanand (Sindhi).
25	15	SAURA MAGHA				25- Pongal (S. India), Makara Snana, Tila Samkranti, Tai Pongal (Kerala), Tamil New Year's Day, Magha Bihu (Assam), Makara Samkranti (N.India), Makara Samkranti.
26	16					26- Mattu Pongal or Kanuvu (S. India),
27	17					27- Birthday of Swami Vivekananda (according to tithi), Ashtaka (Mamashtaka).
28	18					
29	19				29- Sayana Vyatipata ($29^h 19^m.3$)	
30	Jan. 20			30- Enters Tropical Aquarius ($20^h 24^m.6$)		30- Sattila Ekadasi.

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Vrischika 2, $11^h 52^m.7$; Dhanus 4, $16^h 41^m.1$; Makara 6, $23^h 45^m.1$; Kumbha 9, $9^h 34^m.6$; Mina 11, $21^h 38^m.3$; Mesha 14, $10^h 05^m.4$; Vrisha 16, $20^h 36^m.4$; Mithuna 18, $27^h 49^m.1$; Karkata 21, $7^h 52^m.0$; Simha 23, $9^h 55^m.3$; Kanya 25, $11^h 28^m.3$; Tula 27, $13^h 49^m.2$; Vrischika 29, $17^h 47^m.6$; Sun enters :- Nirayana Makara 24, $26^h 08^m.1$.

SAKA ERA 1941

Kumbha : Tapasya

Winter (Sisira), 2nd Month

Month of MAGHA (30 days)

(*Nirayana*) 8 Magha, 5120 Kali Era to (*Nirayana*) 7 Phalguna, 5120 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi				Nakshatra			Yoga		
										No.		Ending Moment		No.	Ending Moment		No.	Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2020 A.D.																	
1	Tue	Jan.	21	6	43.3	12	11.0	17	39.2	K	12	25	45.3	18	23	43.1	12	28	46.8
2	Wed		22	6	43.1	12	11.4	17	39.9		13	25	49.1	19	24	19.8	13	27	39.8
3	Thu		23	6	43.0	12	11.6	17	40.6		14	26	17.9	20	25	20.6	14	26	52.0
4	Fri		24	6	42.8	12	11.9	17	41.3	K	30	27	12.0	21	26	45.9	15	26	23.7
5	Sat		25	6	42.6	12	12.1	17	42.0	S	1	28	31.6	22	28	35.5	16	26	14.7
6	Sun		26	6	42.3	12	12.4	17	42.7		2	30	15.9	23	-	-	17	26	24.3
7	Mon		27	6	42.1	12	12.6	17	43.4		3	-	-	23	6	48.7	18	26	51.3
8	Tue		28	6	41.8	12	12.8	17	44.1		3	8	22.4	24	9	22.9	19	27	31.6
9	Wed		29	6	41.5	12	13.0	17	44.8		4	10	46.3	25	12	13.3	20	28	21.1
10	Thu		30	6	41.1	12	13.2	17	45.5	S	5	13	19.7	26	15	12.4	21	29	12.9
11	Fri		31	6	40.8	12	13.3	17	46.2		6	15	52.2	27	18	09.8	22	29	58.6
12	Sat	Feb.	1	6	40.4	12	13.5	17	46.8		7	18	11.2	1	20	53.5	23	30	29.4
13	Sun		2	6	40.0	12	13.6	17	47.5		8	20	04.1	2	23	11.2	24	30	36.5
14	Mon		3	6	39.6	12	13.7	17	48.2		9	21	19.6	3	24	52.3	25	30	12.7
15	Tue		4	6	39.1	12	13.8	17	48.8	S	10	21	50.0	4	25	49.2	26	29	12.9
16	Wed		5	6	38.7	12	13.9	17	49.5		11	21	31.3	5	25	58.5	27	27	34.9
17	Thu		6	6	38.2	12	14.0	17	50.1		12	20	23.9	6	25	20.9	1	25	19.3
18	Fri		7	6	37.7	12	14.0	17	50.7		13	18	31.9	7	24	00.6	2	22	29.1
19	Sat		8	6	37.2	12	14.1	17	51.3		14	16	02.1	8	22	05.0	3	19	09.8
20	Sun		9	6	36.6	12	14.2	17	52.0	S	15	13	03.2	9	19	43.2	4	15	28.0
21	Mon		10	6	36.1	12	14.2	17	52.6	K	1	9	45.2	10	17	05.7	5	11	31.6
											(2	30	18.5)						
22	Tue		11	6	35.5	12	14.2	17	53.2		3	26	53.3	11	14	23.2	6	7	28.7
																	(7	27	27.7)
23	Wed		12	6	34.9	12	14.2	17	53.8		4	23	39.8	12	11	46.3	8	23	36.5
24	Thu		13	6	34.3	12	14.2	17	54.3	K	5	20	46.8	13	9	24.9	9	20	02.1
25	Fri		14	6	33.7	12	14.2	17	54.9		6	18	21.5	14	7	27.6	10	16	50.1
														(15	30	00.9)			
26	Sat		15	6	33.0	12	14.1	17	55.5		7	16	29.6	16	29	09.0	11	14	04.8
27	Sun		16	6	32.4	12	14.1	17	56.1		8	15	14.2	17	28	53.6	12	11	48.4
28	Mon		17	6	31.7	12	14.0	17	56.6		9	14	35.9	18	29	13.7	13	10	01.4
29	Tue		18	6	31.0	12	13.9	17	57.2	K	10	14	33.1	19	30	06.4	14	8	42.6
30	Wed		19	6	30.3	12	13.9	17	57.7	K	11	15	02.6	20	-	-	15	7	49.5

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

Uttarayana — SAKA ERA 1941

Dakshina Gola — Month of MAGHA (30 days) — Ayanamsa on 1st : 24° 07′ 58″

(*Nirayana*) 8 Magha, 5120 Kali Era to (*Nirayana)* 7 Phalguna, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D.					
1	Jan. 21	SAURA MAGHA	CHAANDRA PAUSHA			1- Martyrdom Day of Hemu Kalani (Sindhi).
2	22					2- Meru Trayodasi (Jain).
3	23					3- Netaji's Birthday, Ratanti Kalika Puja.
4	24			4- Enters Sravana nak. ($21^h 51^m.4$)	4- New Moon ($27^h 12^m.0$)	4- Mauni Amavasya, Tai Amavasya, Makara Vavu (Kerala).
5	25		CHAANDRA MAGHA			5- Magha Sukladi.
6	26					6- Republic Day.
7	27					
8	28					8- Birthday of Lala Lajpat Rai, Varada Chaturthi, Tila Chaturthi, Kunda Chaturthi, Ganesa Puja (Bengal).
9	29					
10	30					10- Martyr's Day (Mahatma Gandhi Commemoration Day), Vasanta Panchami, Sarasvati Puja, Sri Panchami.
11	31					
12	Feb. 1					12- Ratha Saptami (Purvarunodaya), Vidhana Saptami, Arogya Saptami.
13	2				13- Sayana Vaidhriti ($15^h 38^m.9$)	13- Bhismashtami.
14	3					
15	4					
16	5					16- Jaya Ekadasi, Bhaimi Ekadasi (Bengal).
17	6			17- Enters Dhanishtha ($24^h 57^m.5$)		17- Bhishma Dvadasi.
18	7					18- Desert Festival- 3 days(Jaisalmer).
19	8					19- Floating Festival (Tai Poosam).
20	9				20- Full Moon ($13^h 03^m.2$)	20- Maghi Purnima, Guru Ravi Das's Birthday (according to tithi).
21	10					
22	11					
23	12			23- Saura Phalgunadi ($18^h 04^m.9$)		
24	13					
25	14	SAURA PHALGUNA			25- Sayana Vyatipata ($14^h 22^m.7$)	
26	15					26- Vaikkatashtami (Kerala)
27	16					27- Ashtaka (Sakashtaka), Janaki Janma.
28	17					
29	18					29- Birthday of Swami Dayananda Saraswati (Founder of Arya Samaj)(according to tithi).
30	Feb. 19			30- Enters Trop. Pisces ($10^h 27^m.0$) 30- Enters Satabhisaj ($29^h 29^m.7$)		30- Vijaya Ekadasi, Sivaji Jayanti.

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Dhanus 1, $23^h 43^m.1$; Makara 4, $7^h 39^m.6$; Kumbha 6, $17^h 39^m.3$; Mina 8, $29^h 29^m.5$; Mesha 11, $18^h 09^m.8$; Vrisha 13, $29^h 40^m.3$; Mithuna 16, $13^h 59^m.8$; Karkata 18, $18^h 24^m.3$; Simha 20, $19^h 43^m.2$; Kanya 22, $19^h 43^m.0$; Tula 24, $20^h 22^m.9$; Vrischika 26, $23^h 18^m.7$; Dhanus 28, $29^h 13^m.7$; Sun enters :- Nirayana Kumbha 24, $15^h 03^m.6$.

INDIAN CALENDAR

SAKA ERA 1941

Mina : Madhu

Month of PHALGUNA (30 days)

Spring (Vasanta), 1st Month

(*Nirayana*) 8 Phalguna, 5120 Kali Era to (*Nirayana)* 7 Chaitra, 5120 Kali Era

Date	Week Day	Gregorian Date		Sunrise		Apparent Noon		Sunset		Tithi				Nakshatra			Yoga		
										No.		Ending Moment		No.	Ending Moment		No.	Ending Moment	
				h	m	h	m	h	m			h	m		h	m		h	m
		2020 A.D.																	
1	Thu	Feb.	20	6	29.6	12	13.8	17	58.2	K	12	16	00.1	20	7	27.7	16	7	18.9
2	Fri		21	6	28.8	12	13.7	17	58.8		13	17	21.5	21	9	13.4	17	7	07.7
3	Sat		22	6	28.1	12	13.6	17	59.3		14	19	03.2	22	11	19.4	18	7	12.9
4	Sun		23	6	27.3	12	13.4	17	59.8	K	30	21	02.0	23	13	42.7	19	7	32.0
5	Mon		24	6	26.5	12	13.3	18	00.3	S	1	23	15.4	24	16	20.7	20	8	03.2
6	Tue		25	6	25.7	12	13.1	18	00.8		2	25	40.2	25	19	10.4	21	8	44.5
7	Wed		26	6	24.9	12	13.0	18	01.8		3	28	12.2	26	22	08.1	22	9	33.4
8	Thu		27	6	24.1	12	12.8	18	01.8		4	-	-	27	25	08.2	23	10	26.4
9	Fri		28	6	23.3	12	12.7	18	02.3		4	6	44.9	1	28	02.7	24	11	18.9
10	Sat		29	6	22.4	12	12.5	18	02.7	S	5	9	09.8	2	-	-	25	12	04.3
11	Sun	Mar.	1	6	21.6	12	12.3	18	03.2		6	11	16.3	2	6	42.0	26	12	35.3
12	Mon		2	6	20.7	12	12.1	18	03.7		7	12	53.3	3	8	55.1	27	12	43.8
13	Tue		3	6	19.8	12	11.9	18	04.1		8	13	50.5	4	10	31.6	1	12	22.2
14	Wed		4	6	19.0	12	11.7	18	04.6		9	14	00.4	5	11	23.4	2	11	24.7
15	Thu		5	6	18.1	12	11.4	18	05.0	S	10	13	19.2	6	11	25.8	3	9	47.7
16	Fri		6	6	17.2	12	11.2	18	05.4		11	11	47.4	7	10	38.4	4	7	30.4
																	(5	28	35.1)
17	Sat		7	6	16.3	12	11.0	18	05.9		12	9	29.2	8	9	04.9	6	25	06.3
18	Sun		8	6	15.3	12	10.7	18	06.3		13	6	31.7	9	6	52.2	7	21	10.9
											(14	27	04.2)	(10	28	09.8)			
19	Mon		9	6	14.4	12	10.5	18	06.7	S	15	23	17.7	11	25	08.8	8	16	57.2
20	Tue		10	6	13.5	12	10.2	18	07.1	K	1	19	23.7	12	22	01.5	9	12	34.3
21	Wed		11	6	12.6	12	10.0	18	07.5		2	15	33.9	13	18	59.9	10	8	11.5
																	(11	27	58.3)
22	Thu		12	6	11.6	12	09.7	18	07.9		3	11	59.5	14	16	15.7	12	24	03.5
23	Fri		13	6	10.7	12	09.4	18	08.3		4	8	51.0	15	13	59.5	13	20	34.5
24	Sat		14	6	09.7	12	09.1	18	08.7	K	5	6	17.4	16	12	20.0	14	17	37.3
											(6	28	25.7)						
25	Sun		15	6	08.8	12	08.8	18	09.1		7	27	19.7	17	11	23.4	15	15	15.7
26	Mon		16	6	07.8	12	08.6	18	09.5		8	27	00.2	18	11	12.3	16	13	31.2
27	Tue		17	6	06.8	12	08.3	18	09.9		9	27	24.3	19	11	46.1	17	12	22.6
28	Wed		18	6	05.9	12	08.0	18	10.3	K	10	28	26.7	20	13	00.7	18	11	46.6
29	Thu		19	6	04.9	12	07.7	18	10.7		11	29	59.9	21	14	49.6	19	11	38.2
30	Fri		20	6	03.9	12	07.4	18	11.1	K	12	-	-	22	17	05.0	20	11	51.7

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

INDIAN CALENDAR

SAKA ERA 1941

Uttarayana
Dakshina Gola

Month of PHALGUNA (30 days)

Ayanamsa on 1st : $24^{0}08^{/}02^{//}$

(*Nirayana*) 8 Phalguna, 5120 Kali Era to (*Nirayana)* 7 Chaitra, 5120 Kali Era

Date	Gregorian Date	Solar Month	Lunar Month	Transit of the Sun	Phenomena	Festivals
	2020 A.D.					
1	Feb. 20	SAURA PHALGUNA	CHAANDRA MAGHA			1- Maha Sivaratri (Kashmir).
2	21					2- Maha Sivaratri, Sivaratri (S. India).
3	22					
4	23				4- New Moon ($21^h 02^m.0$)	
5	24		CHAANDRA PHALGUNA			
6	25					6- Birthday of Sri Ramakrishna (according to tithi).
7	26					
8	27				8- Sayana Vaidhriti ($19^h 53^m.1$)	
9	28					
10	Mar. 1					
11	2					
12	3					12- Holashtaka.
13	4					
14	5			14- Enters Purva Bhadrapada ($11^h 42^m.6$)		
15	6					
16	7					16- Amlaki Ekadasi, Govinda Dvadasi.
17	8					
18	9					18- Masi Magham.
19	10				19- Full Moon ($23^h 17^m.7$)	19- Holikadahana, Birthday of Sri Chaitanya, Dolyatra.
20	11				20- Sayana Vyatipata ($29^h 49^m.8$)	20- Holi, Hola, Vasantotsava.
21	12					
22	13					
23	14			23- Saura Chaitradi ($14^h 36^m.0$)		23- Ranga Panchami.
24	15					24- Bijoy Govindaji Halangkar (Manipur).
25	16	SAURA CHAITRA				
26	17					26- Varsitaparambha (Jain), Sitalashtami.
27	18			27- Enters Uttara Bhadrapada ($20^h 13^m.5$)		
28	19					
29	20			29- Enters Trop. Aries ($9^h 19^m.6$)		29- Papamochani Ekadasi (Smarta).
30	Mar. 21					30- Indian Year Ending day, Vanjuli Mahadvadasi, Mahavishuva day, Ekadasi (Vaishnava & Vidhava).
	1942 S.E.					
Chtr.						
1	Mar. 22					1- Indian New Year's Day, MahaVaruni (after $19^h 40^m.0$).

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of $82\frac{1}{2}^0$ E. Long.

Moon enters :- Makara 1, $13^h 52^m.0$; Kumbha 3, $24^h 29^m.1$; Mina 6, $12^h 27^m.1$; Mesha 8, $25^h 08^m.2$; Vrisha 11, $13^h 18^m.2$; Mithuna 13, $23^h 03^m.5$; Karkata 15, $28^h 54^m.9$; Simha 18, $6^h 52^m.2$; Kanya 20, $6^h 22^m.1$; Tula 21, $29^h 34^m.8$; Vrischika 24, $6^h 41^m.0$; Dhanus 26, $11^h 12^m.3$; Makara 28, $19^h 25^m.0$; Sun enters: Nirayana Mina 24, $11^h 53^m.8$.

PRINCIPAL FESTIVALS AND ANNIVERSARIES FOR HOLIDAYS

Festivals	Criterion	Date
		National / Nirayana / Gregorian Saka 1940/Kali 5119 /2019 A.D.
72. Guru Gobind Singh's Birthday	Pausha S 7	Pausha 23 / Pausha 30 / Jan 13
73. Bhogi (S.India)	Day before Pongal	Pausha 24 / Magha 1 / Jan.14
74. Makara Samkranti (Bengal)	Saura Maghadi (MidnightRule)	Pausha 24 / Magha 1 / Jan 14
Magha Bihu (Assam)	-do-	Pausha 24 / Magha 1 / Jan. 14
75. Pongal (S.India),Tai Pongal(Kerala)	The day of Saura Maghadi	Pausha 25 / Magha 2 / Jan. 15
Tamil New Year's day ,Tila Samkranti, Makara Sankranti (N.India), Makaradi Snana		Pausha 25 / Magha 2 / Jan. 15
76. Mattu Pongal or Kanuvu	Day after Pongal	Pausha 26 / Magha 3 / Jan. 16
77. Netaji's Birthday	Fixed	Magha 3 / Magha 10 / Jan. 23
78. Republic Day	Fixed	Magha 6 / Magha 13 / Jan. 26
79. Sri Panchami, Vasanta Panchami	Magha S 5	Magha 21 / Magha 28 / Feb 10
80. Sivaji Jayanti	Fixed	Magha 30 / Phalguna 7 / Feb 19
81. Guru Ravidas's Birthday	Magha S 15	Magha 30 / Phalguna 7 / Feb 19
82. Birth Day of Swami Dayananda Saraswati (Founder of Arya Samaj)	Phalguna K 10 (Purnimanta)	Phalguna 10/ Phalguna 17/ March 1
83. Maha Sivaratri (Kashmir)	Magha K 13	Phalguna 12/ Phalguna 19/ March 3
84. Maha Sivaratri	Magha K 14(Prodosa & Nishithavyapini)	Phalguna 13/ Phalguna 20/ March 4
85. Holikadahana	Phalguna S 15 (night)	Phalguna 29 / Chaitra 6 / March 20
86. Dolyatra	Phalguna S 15	Phalguna 30 / Chaitra 7 / March 21
87. Holi	Day after Holikadahana	Phalguna 30 / Chaitra 7 / March 21
88. Hola, Vasantotsava	Phalguna K 1	Phalguna 30 / Chaitra 7 / March 21
89. MahaVishuva day	Day of Sun's entry into Trop . Aries (Midnight rule)	Phalguna 30 / Chaitra 7 / March 21
		Saka 1941/Kali 5119 /2019 A.D.
1. Indian New Year's Day	Fixed	Chaitra 1 / Chaitra 8/ Mar. 22
2. Oli begins (Jain)	8 days before Oli ends	Chaitra 21 / Chaitra 28/ Apr. 11
3. Rama Navami (Smarta)	Chaitra S 9	Chaitra 23 / Chaitra 30/ Apr. 13
		Saka 1941/Kali 5120 /2019 A.D.
4. Rama Navami (Vaishnava)	Chaitra S 9	Chaitra 24 / Vaisakha 1 / April 14
5. Vaisakhi (Punjab,Haryana, H.P,Delhi & Odisha),Visu (Kerala)	SauraVaisakhadi (Sunrise Rule)	Chaitra 24/ Vaisakha 1/April 14
6. Vaisakhadi (Bengal) , Bahag Bihu (Assam), Shilhenba (Manipur)	Day Following Saura Vaisakhadi (Midnight Rule)	Chaitra 25/ Vaisakha 2 / Apr. 15
7. Mahavira Jayanti	Chaitra S 13	Chaitra 27 / Vaisakha 4 / April 17
8. Oli ends (Jain)	Chaitra S 15(Udayvyapini)	Chaitra 29 /Vaisakha 6 / April 19
9. Babu Kuer Singh Day (Bihar)	Fixed	Vaisakha 3 / Vaisakha 10 /Aprl.23
10. May Day	Fixed	Vaisakha 11 / Vaisakha 18 / May 1
11. Tithi of Deva Damodara(Assam)	S1 of Saura Vaisakha	Vaisakha 15 / Vaisakha 22 / May 5
12. Aksaya Tritiya	Vaisakha S 3	Vaisakha 17 / Vaisakha 24 / May 7
13. Birthday of Rabindranath	25 Vaisakha of Beng. Calendar	Vaisakha 19/ Vaisakha 26 / May 9
14. Buddha Purnima	Vaisakha S 15	Vaisakha 28 / Jyaishtha 4 / May 18
15. Pratap Jayanti	Jyaishtha S 3	Jyaishtha 16 / Jyaishtha 23 / June 6
16. Guru Arjan Dev's Martyrdom Day (Sikh)	Jyaishtha S 4	Jyaishtha 17/ Jyaishtha 24 / June 7
17. Rajas Samkranti (Odisha)	Saura Ashadhadi (Sunrise Rule)	Jyaishtha 25 / Ashadha 1 / June 15
18. Rathayatra	Ashadha S 2	Ashadha 13 / Ashadha 20 / July 4
19. Kharchi Puja (Tripura)	Ashadha S 8	Ashadha 18 / Ashadha 25/ July 9
20. Punaryatra	Ashadha S 10	Ashadha 20 /Ashadha 27/ July 11
21. Ultarath, Bahudha Yatra	9^{th} day from Rathayatra	Ashadha 21/ Ashadha 28 / July 12
22. Ker Puja (Tripura)	First Tues. or Sat.day after 14 days from Kharci Puja not falling on K10	Sravana 1 / Sravana 8 / July 23
23.Karkataka Vavu (Kerala)	K 30 of Saura Sravana	Sravana 9 / Sravana 16 / July 31

Festivals numbered 72 to 89 are repetition of the same for Pausha to Phalguna, 1940 S.E., published in the previous year.

PRINCIPAL FESTIVALS AND ANNIVERSARIES FOR HOLIDAYS

Festivals	Criterion	Date
		National / Nirayana / Gregorian Saka 1941/Kali 5120/2019 A.D.
24. Tilak Commemoration Day	Fixed	Sravana 10/ Sravana 17/ Aug 1
25. Jhulana Yatrarambha(Prodosa)	Sravana S 11 (Ratri)	Sravana 19 / Sravana 26 / Aug. 10
26. Jhulana Yatrarambha(Purvahna)	Sravana S 11	Sravana 20 / Sravana 27 / Aug. 11
27. Jhulana Yatrasamapana (Prodosa)	Sravana S 15	Sravana 23 / Sravana 30 / Aug.14
Naroli Purnima	Sravana S 15 (Ratri)	Sravana 23 / Sravana 30 / Aug.14
28. Jhulana Yatrasamapana (Purvahna)	Sravana S 15	Sravana 24 / Sravana 31 / Aug. 15
29. Independence Day	Fixed	Sravana 24 / Sravana 31 / Aug.15
30. Raksha Bandhana , Amar nath yatra,	Sravana S 15(Udayvyapini)	Sravana 24 / Sravana 31 / Aug.15
Solono (Rakhi Bandhan)	Sravana S 15	-do-
Jhulana Purnima ,	Sravana S 15	Sravana 24 / Sravana 31 / Aug.15
Rik Upakarma	Sravana nak . of Chandra Sravana	-do-
31. Tithi of Sri Madhava Deva Assam)	K 5 of Saura Bhadra	Sravana 29 / Bhadra 5 / Aug 20
32. Raksha Panchami (Odisha)	Sravana K 5	Sravana 29 / Bhadra 5 / Aug 20
33. Sri Krishna Jayanti (T.N., Kerala,	K8 of Saura Bhadra	Bhadra 1/ Bhadra 8/ Aug 23
Assam), Janmashtami (Smarta)	Sravana K 8 (Nishitha)	Bhadra 1/ Bhadra 8/ Aug 23
34. Sri Jayanti (Ramanuja),	Rohini nakshatra of Saura Bhadra	Bhadra 2 / Bhadra 9/ Aug 24
Janmashtami (Vaishnava)	Sravana K 8	Bhadra 2/ Bhadra 9/ Aug 24
35. Gokulashtami (Nandotsava)	Day after Janmashtami	Bhadra 2/ Bhadra 9/ Aug 24
36. Paryusana Parvarambha (Chaturthi Paksha –Jain)	7 days before Samvatsari (Chaturthi paksha)	Bhadra 4/ Bhadra 11/ Aug 26
37. Paryusana Parvarambha (Panchami Paksha –Jain)	7 days before Samvatsari (Panchami paksha)	Bhadra 5 / Bhadra 12 / Aug 27
38. Samvatsari(Chaturthi paksha)Jain	Bhadra S 4 (Udayavyapini)	Bhadra 11 / Bhadra 18 / Sept 02
39. Vinayak Chaturthi (T.N),Ganesh Chaturthi	S4 of Saura Bhadra	Bhadra 11 / Bhadra 18 / Sept 02
40. Samvatsari(Panchami paksha) Jain	Bhadra S 5 current at Sunset	Bhadra 12 / Bhadra 19 / Sept 03
41. Radhashtami	Bhadra S 8	Bhadra 15 / Bhadra 22 / Sept 06
42. First Onam Day	Day before Thiru Onam Day	Bhadra 19 / Bhadra 26 / Sept 10
43. Onam or Thiru Onam Day	Sravana nak.of Saura Bhadra	Bhadra 20 / Bhadra 27 / Sept 11
44. Third Onam day	Day after Thiru Onam day	Bhadra 21 / Bhadra 28/ Sept 12
45. Ananta Chaturdasi	Bhadra S 14	Bhadra 21 / Bhadra 28 / Sept 12
46. Fourth Onam day	2 days after Thiru Onam day	Bhadra 22 / Bhadra 29 / Sept 13
47. Mahalaya Amavasya ,Sarvapitri Amavasya (Odisha)	Bhadra K 30	Asvina 6 / Asvina 13 / Sept 28
48. Sthapana Navaratrarambha (Saradia)	Asvina S1	Asvina 7 / Asvina 14 / Sept 29
49. Mahatma Gandhi's Birthday	Fixed	Asvina 10/ Asvina 17 / Oct 2
50. Durga Puja (Saptami)	Asvina S 7	Asvina 13/ Asvina 20 / Oct 5
Oli begins (Jain)	8 days before Oli ends	Asvina 13 / Asvina 20 / Oct 5
51. Durga Puja (Maha Astami)	Asvina S 8	Asvina 14 / Asvina 21 / Oct 6
52. Durga Puja (Maha Navami)	Asvina S 9	Asvina 15 / Asvina 22 / Oct 7
53. Ayudha Puja	Day before Dussehra	Asvina 15 / Asvina 22 / Oct 7
54. Vijaya Dasami (Dussehra or Dasahara)	Asvina S 10 ((Aparahna)	Asvina 16 / Asvina 23 / Oct 8
55. Vijaya Dasami (Bengal & kerala)	Asvina S 10 (Purvahna)	Asvina 16 / Asvina 23 / Oct 8
56. Kojagori Lakshmi Puja (Bengal)	Asvina S 15 (prodosa)	Asvina 21 / Asvina 28 / Oct 13
57. Kumara Purnima (Odisha)	Asvina S 15	Asvina 21 / Asvina 28 / Oct 13
58. Maharsi Valmiki's Birthday (according to tithi)	Asvina S 15	Asvina 21 / Asvina 28 / Oct 13
59. Oli ends (Jain)	Asvina S 15 (Udayvyapini)	Asvina 21 / Asvina 28 / Oct 13
60. Naraka Chaturdasi (Purvarunodaya) (S.India)	Asvina K 14 ((Purvarunodaya)	Kartika 5/ Kartika 12 /Oct 27
61. Dipavali (S.India)	Asvina K 14	Kartika 5/ Kartika 12 /Oct 27
62. Kali Puja	Asvina K 30 (Nishithvyapini)	Kartika 5/ Kartika 12 /Oct 27
63. Dipavali	Asvina K 30	Kartika 5 / Kartika 12 /Oct 27
64. Govardhan Puja	Kartika S 1	Kartika 6/ Kartika 13 /Oct 28
65. Kartika Sukladi	Kartika S 1	Kartika 6 / Kartika 13 / Oct 28
66. Bali Puja	Kartika S 1	Kartika 6 / Kartika 13 / Oct 28
67. Annakuta	Kartika S 1	Kartika 6 / Kartika 13 / Oct 28
68. Bhratri Dvitiya, Dwat Puja,	Kartika S 2 (Aparahna)	Kartika 7/ Kartika 14 / Oct 29

PRINCIPAL FESTIVALS AND ANNIVERSARIES FOR HOLIDAYS

Festivals	Criterion	Date
		National / Nirayana / Gregorian
		Saka 1941/Kali 5120/2019 A.D.
Tikka Ceremony, Bhai Duj	Kartika S 2 (Aparahna)	Karttika 7/ Kartika 14 /Oct 29
Bhratri Dvitiya (Bengal)	Kartika S 2 (Madhyahna)	Karttika 7/ Kartika 14 /Oct 29
69. Pratihar Shashthi or Surya Shashthi , Chhat- Bihar	Kartika S 6	Kartika 11 / Kartika 18 /Nov 02
70. Goshtashtami or Gopashtami	Kartika S 8	Kartika 13/ Kartika 20/ Nov 04
Rasayatra (Smarta)	Kartika S 15 (Nisithavyapini)	Kartika 20 / Kartika 27 / Nov 11
71. Rasayatra (Vaishnava)	Kartika S 15 (Udayavyapini)	Kartika 21/ Kartika 28/ Nov.12
72. Guru Nanak's Birthday	Kartika S 15 (Udayavyapini)	Kartika 21/ Kartika 28 /Nov 12
Ratha Yatra (Jain),	Kartika S 15 (Udayavyapini)	Kartika 21/ Kartika 28 /Nov 12
Kartiki Purnima,	Kartika S 15	Kartika 21/ Kartika 28 /Nov 12
Pushkar Fair	Kartika S 15	
73. Prathamastami (Odisha)	Kartika K 8	Kartika 29 / Agrahn.6 / Nov 21
74. Guru Teg Bahadur's Martyrdom Day	Fixed	Agrahayana 3 / Agrahn.10 / Nov24
75. Huthri –(3 days.) Coorg	S15 to K2 of Saura Margasirsha	Agrahayana 21/Agrahn. 28 /Dec 12
76. Jor Mela (Punjab)	Fixed	Pausha 5 / Pausha 12 /Dec 26
		Saka 1941/Kali 5120 /2020 A.D.
77. Guru Gobind Singh's Birth Day	Pausha S 7	Pausha 12 / Pausha 19 / Jan 02
78. Vaikuntha Ekadasi (S.India)	S 11 of Saura Pausha	Pausha 16/ Pausha 23 / Jan 06
79. Bhogi (S.India)	Day before Pongal	Pausha 24 / Magha 1 / Jan.14
80. Makara Samkranti (Bengal)	Saura Maghadi (Midnight Rule)	Pausha 25 / Magha 2 / Jan 15
Magha Bihu (Assam)	-d0-	Pausha 25 / Magha 2 / Jan. 15
81. Pongal (S.India),Tai Pongal(Kerala)	The day of Saura Maghadi	Pausha 25 / Magha 2 / Jan. 15
Tamil New Year's day ,Tila Samkranti,	The day of Saura Maghadi	Pausha 25 / Magha 2 / Jan. 15
Makara Samkranti (N. India) Makaradi snana		Pausha 25 / Magha 2 / Jan. 15
82. Mattu Pongal or Kanuvu	Day after Pongal	Pausha 26 / Magha 3 / Jan. 16
83. Netaji's Birthday	Fixed	Magha 3 / Magha 10 / Jan. 23
84. Republic Day	Fixed	Magha 6 / Magha 13 / Jan. 26
85. Sri Panchami, Vasanta Panchami	Magha S 5	Magha 10 / Magha 17 / Jan 30
86. Guru Ravidas's Birthday	Magha S 15	Magha 20 / Magha 27 / Feb 9
87. Birth Day of Swami Dayananda Saraswati (Founder of Arya Samaj")	Phalguna K 10 (Purnimanta)	Magha 29/ Phalguna 6/ Feb 18
88. Sivaji Jayanti	Fixed	Magha 30 / Phalguna 7 / Feb 19
89. Maha Sivaratri (Kashmir)	Magha K 13	Phalguna 1/ Phalguna 8/ Feb 20
90. Maha Sivaratri	Magha K 14 (Prodosa & Nishithavyapini)	Phalguna 2/ Phalguna 9 / Feb 21
91. Holikadahana	Phalguna S 15 (night)	Phalguna 19 / Phalguna 26/March 9
92. Dolyatra	Phalguna S 15	Phalguna 19 / Phalguna 26/March 9
93. Holi	Day after Holikadahana	Phalguna 20 /Phalguna 27/March 10
94. Hola,Vasantatsava	Phalguna K 1	Phalguna 20 /Phalguna 27/March 10
95. MahaVishuva day	Day of Sun's entry into Trop . Aries (Midnight rule)	Phalguna 30 / Chaitra 6 / March 20
Special Festivals for Jammu and Kashmir		
		National / Nirayana / Gregorian
		Saka 1940/ Kali 5119/ 2019 A.D.
7. Lohri	Day before Saura Maghadi (Sunrise Rule)	Pausha 23/ Pausha 30/ Jan. 13
		Saka 1941/ Kali 5119/ 2019 A.D.
1. Mela Bahu Fort	Chaitra S 8	Chaitra 23 / Chaitra 30 / April 13
		Saka 1941 / Kali 5120 / 2019 A.D
2. Mela Kshir Bhawani (2 days)	Jyaishtha S 8	Jyaishtha 20 / Jyaishtha 27/June 10
3. Guru Hargobind's Birthday	Jyaishtha K 1	Jyaishtha 28 / Ashadha 4 / June 18
4. Martyr's Day	Fixed	Asadha 22 / Asadha 29 / July 13
5. Kailas Yatra	Sravana K 13, K 14	Bhadra 6 / Bhadra 13 / Aug 28
6. Mela Pat	Bhadra S 5 to S 7	Bhadra 12 / Bhadra 19 / Sept 3
		Saka 1941/ Kali 5120 / 2020 A.D.
7. Lohri	Day before Saura Maghadi (Sunrise Rule)	Pausha 23 / Pausha 30 / Jan. 13

MOSLEM FESTIVALS, 2019-2020 A.D.

Festivals	Criterion	Date
		National / Nirayana / Gregorian
		Saka 1941 / Kali 5119 / 2019 A.D
1. Sab-e-Miraj *	27 Rajab	Chaitra 14 / Chaitra 21 / April 4
		Saka 1941 / Kali 5120 / 2019 A.D
2. Sab-e-Barat*	15 Shaban	Vaisakha 1 / Vaisakha 8 / April 21
3. First day of Ramadan	1 Ramadan	Vaisakha 17 / Vaisakha 24 / May 7
4. Shahadat-e-Hazrat Ali	21 Ramadan	Jyaishtha 6 / Jyaishtha 13/ May 27
5. Jumat Ul Vida	Last Friday of Ramadan	Jyaishtha 10 / Jyaishtha 17/ May 31
6. Sab –e- Qadr *.	27 Ramadan	Jyaishtha 12 / Jyaishtha 19/ June 2
7. Id-ul -Fitr	1 Shawwal	Jyaishtha 15 / Jyaishtha 22 / June 5
8. Id-uz -Zuha (Bakrid)	10 Zulhijja	Sravana 21 / Sravana 28 / Aug 12
9. Muharram	10 Muharram	Bhadra 19 /Bhadra 26 / Sept. 10
10. Chelhum	Fortieth day from (39 days after) 10 Muharram	Asvina 27 / Kartika 4 / Oct 19
11. Akheri Chahar Shumba	Last Wednesday of Safar	Kartika 1 / Kartika 8 / Oct 23
12. Shahadat –e- Iman Hasan	28 Safar	Kartika 6 / Kartika 13 / Oct 28
13. Milad-un Nabi or Id-e-Milad(Birth Day of the Prophet), Fateha Dwaz Daham or Bara Wafat	12 Rabiu'l awwal	Kartika 19 / Kartika 26 / Nov.10
14. Id-e-Maulad	17 Rabiu'l awwal	Kartika 24 / Agrahayana 1 /Nov 15
15. Fateha Yazdadham (Giarhween Sharif)	11 Rabius Sani	Agrah. 18/ Agrahayana 25 / Dec 9
		Saka 1941 / Kali 5120 / 2020 A.D
16. Hazrat ali's Birthday	13 Rajab	Phalguna 19 / Phalguna 26 /March 9
		Saka 1942 / Kali 5120 / 2020 A.D
17. Sab-e-Miraj *	27 Rajab	Chaitra 3/ Chaitra 9 /March 23
18. Sab-e-Barat *	15 Shaban	Chaitra 20/ Chaitra 26 /April 9

* The festival is observed in the preceding night

THE ISLAMIC CALENDAR 2019-2020 A.D. (Hejira : 1440-1441 A. H.)

The beginning dates of the different months of the Islamic Calendar for the year 2019-2020 A.D. determined on the basis of the first visibility of the lunar crescent after the New-Moon day culculated for the Central Station of India are as follows:-

Jumadu'l awwal	1440	Jan. 8	2019	(30)	MUHARRAM	1441	Sept. 1	2019	(30)
Jumadu's sani	"	Feb. 7	"	(30)	Safar	"	Oct. 1	"	(29)
Rajab	"	Mar. 9	"	(29)	Rabiu'l awwal	"	Oct. 30	"	(30)
Shaban	"	Apr. 7	"	(30)	Rabiu's sani	"	Nov. 29	"	(29)
Ramadan	"	May 7	"	(29)	Jumadu'l awwal	"	Dec. 28	"	(30)
Shawwal	"	Jun. 5	"	(30)	Jumadu's sani	"	Jan. 27	2020	(30)
Zu'lqada	"	Jul. 5	"	(29)	Rajab	"	Feb. 26	"	(29)
Zulhijja	"	Aug. 3	"	(29)	Shaban	"	Mar. 26	"	(30)

N.B.-Actually the months begin from sunset of the preceding day when the Moon becomes first visible.

Fixed Calendar

According to the Fixed Calendar the beginning dates of different months are as follows : 2019 - Jan. 7, Feb. 8, Mar. 8, Apr. 6, May 6, June 4, July 4, Aug. 1, Sept. 1, Sept. 30, Oct. 29, Nov. 28, Dec. 27 2020 - Jan. 25, Feb. 27, Mar. 24, Apr. 25.

THE PARSI (SHAHENSHAHI) CALENDAR, 2019 - 2020 A.D.

(As used by the Indian Parsis)

Yazdejardi Era : 1388 - 1389

The beginning dates of different months of the Parsi Shahenshahi Calendar are as follows :
As regards the Parsi Kadmi Calendar, the months are the same but they begin 30 days earlier.

Shahrivar	1388	Jan. 14	2019	(30)	Ardibehesht	1389	Sept. 16	2019	(30)
Meher	"	Feb. 13	"	(30)	Khordad	"	Oct. 16	"	(30)
Avan	"	Mar. 15	"	(30)	Tir	"	Nov. 15	"	(30)
Adar	"	Apr. 14	"	(30)	Amardad	"	Dec. 15	"	(30)
Dei	"	May 14	"	(30)	Shahrivar	"	Jan. 14	2020	(30)
Bahman	"	June 13	"	(30)	Meher	"	Feb. 13	"	(30)
Aspandad	"	July 13	"	(30)	Avan	"	Mar. 14	"	(30)
Gathas(I-V)	"	Aug. 12	"	(5)	Adar	"	Apr. 13	"	(30)
FARVARDIN	1389	Aug. 17	"	(30)	Dei	"	May 13	"	(30)

PARSI FESTIVALS 2019-2020 A.D.

Festivals	Criterion	Shahenshahi	Kadmi
		National / Nirayana / Gregorian **Saka 1941/ Kali 5120/ 2019 A.D.**	**National / Nirayana / Gregorian** **Saka 1941/ Kali 5120/ 2019 A.D.**
Zarthost-no-Diso	11 Dei	Jyaishtha 3/ Jyaishtha 10/ May 24	Vaisakha 4/ Vaisakha 11/ Apr. 24
Gatha Gahambar	Gatha III	Sravana 23/ Sravana 30/ Aug. 14	Ashadha 24/ Ashadha 31/ July 15
Parsi New Year Eve	Gatha V	Sravana 25/ Bhadra 1/ Aug. 16	Ashadha 26/ Sravana 2/ July 17
Parsi New Year's Day	1 Farvardin	Sravana 26/ Bhadra 2/ Aug. 17	Ashadha 27/ Sravana 3/ July 18
Khordad Sal (Birthday of Prophet Zarthost)	6 Farvardin	Shravana 31/ Bhadra 7/ Aug. 22	Sravana 1/ Sravana 8/ July 23

N.B.- Jamshedi Naoroj falls on March 21 every year

THE JEWISH CALENDAR, 2019 - 2020 A.D.

Jewish Era : 5779 - 80 A.M.

To beginning dates of different months of the Jewish Calendar are as follows:

Shebat	5779	Jan.	7	2019	(30)	TISHRI	5780	Sept.	30	2019	(30)
Veadar	"	Feb.	6	"	(30)	Heshvan	"	Oct.	30	"	(30)
Adar	"	Mar.	8	"	(29)	Kislev	"	Nov.	29	"	(30)
Nisan	"	Apr.	6	"	(30)	Tebeth	"	Dec.	29	"	(29)
Iyar	"	May	6	"	(29)	Shebat	"	Jan.	27	2020	(30)
Sivan	"	June	4	"	(30)	Adar		Feb.	26	"	(29)
Tammuz	"	July	4	"	(29)	Nisan	"	Mar.	26	"	(30)
Ab	"	Aug.	2	"	(30)	Iyar	"	Apr.	25	"	(29)
Ellul	"	Sept.	1	"	(29)						

JEWISH FESTIVALS 2019-2020 A.D.

Festivals	Criterion	Date
		National / Nirayana / Gregorian
		Saka 1940/Kali 5119 / 2019 A.D.
Purim	14 Adar	Phalguna 30/ Chaitra 7 / March 21
		Saka 1941 / Kali 5120 / 2019 AD
First day of Passover (Pesach)	15 Nisan	Chaitra 30 / Vaisakha 7 / April 20
Feast of Weeks (Shebuoth)	6 Sivan	Jyaishtha 19 / Jyaishtha 26 / June 9
Tishabeab	9 Ab	Sravana 19 / Sravana 26 / Aug 10
Jewish New Year (Rosh Hashanah)	1 Tishri	Asvina 8/ Asvina 15 / Sept 30
Day of Atonement (Yom Kippur)	10 Tishri	Asvina 17 / Asvina 24 /Oct 9
First day of Tabernacles (Succoth)	15 Tishri	Asvina 22/ Asvina 29 / Oct 14
Last day of Succoth (SimhathTorah)	23 Tishri	Asvina 30 / Kartika 7 /October 22
Hanukah	25 Kislev	Pausha 2 /Pausha 9 / Dec 23
		Saka 1941/Kali 5120 / 2020 A.D.
Purim	14 Adar	Phalguna 20/ Phalguna 27 / March 10
		Saka 1942/Kali 5120 / 2020 A.D.
First day of Passover (Pesach)	15 Nisan	Phalguna 20/ Phalguna 27 / March 10

CHRISTIAN FESTIVALS, 2019-2020 A.D.

Festivals	Criterion	Date
		National / Nirayana / Gregorian
		Saka 1940 / Kali 5119/ 2019 A.D.
1. Christian (English) New Year's Day	Fixed	Pausha 11 / Pausha 18 / Jan. 01
2. Epiphany	Fixed	Pausha 16 / Pausha 23 / Jan. 06
3. Septuagesima Sunday	63 days before Easter Sunday	Magha 28 / Phalguna 5 / Feb 17
4. Quinquagesima (Shrove) Sunday	49 days before Easter Sunday	Phalguna 12/Phalguna 19 /March 3
5. Ash Wednesday	46 days before Easter Sunday	Phalguna 15 /Phalguna 22/March 6
		Saka 1941/ Kali 5120 / 2019 A.D.
6. Palm Sunday	7 days before Easter Sunday	Chaitra 24/Vaisakha 1 / April 14
7. Good Friday	2 days before Easter Sunday	Chaitra 29/ Vaisakha 6 / April 19
8. Easter (Holy) Saturday	Day before Easter Sunday	Chaitra 30/ Vaisakha 7 / April 20
9. Easter Sunday	First Sunday after the 14th day of the Moon (nearly Full Moon) occurring on or immediately after March 21	Vaisakha 1/Vaisakha 8/April 21
10. Low Sunday	7 days after Easter Sunday	Vaisakha 8/Vaisakha 15/April 28
11. Rogation Sunday	35 days after Easter Sunday	Jyaishtha 5/Jyaishtha 17 / May 26
12. Ascension Day-Holy Thursday	39 days after Easter Sunday	Jyaishtha 9 /Jyaishtha 16 / May 30
13. Ascension Sunday	3 days after Ascension day	Jyaishtha 12/Jyaishtha 19/ June 02
14. Whit Sunday-Pentecost	49 days after Easter Sunday	Jyaishtha 19/Jyaishtha 26 /June 09
15. Trinity Sunday	56 days after Easter Sunday	Jyaishtha 26 / Ashadha 02/June 16
16. Corpus Christi (Thursday)	60 days after Easter Sunday	Jyaishtha 30 / Ashadha 06/June 20
17. First Sunday in Advent	Fourth Sunday before Christmas, i.e.,Sunday nearest to Nov.,30.	Agrahn. 10 / Agrahn. 17 / Dec 01
18. Christmas Eve	Day before Christmas	Pausha 03 / Pausha 10 / Dec. 24
19. Christmas Day	Fixed	Pausha 04 / Pausha 11 / Dec. 25
20. New Year Eve	Fixed	Pausha 10 / Pausha 17 / Dec. 31
		Saka 1941/ Kali 5120 / 2020 A.D.
1. Christian (English) New Year's Day	Fixed	Pausha 11 / Pausha 18 / Jan. 01
2 Epiphany	Fixed	Pausha 16 / Pausha 23 / Jan. 06
3. Septuagesima Sunday	63 days before Easter Sunday	Magha 20 / Magha 27 / Feb 09
4. Quinquagesima (Shrove) Sunday	49 days before Easter Sunday	Phalguna 04/Phalguna 11 / Feb 23
5. Ash Wednesday	46 days before Easter Sunday	Phalguna 07/ Phalguna 14 / Feb 26
		Saka 1942 / Kali 5120/ 2020 A.D.
6. Palm Sunday	7 days before Easter Sunday	Chaitra 16/ Chaitra 22 / April 05
7. Good Friday	2 days before Easter Sunday	Chaitra 21/ Chaitra 27 / April 10
8. Easter (Holy) Saturday	Day before Easter Sunday	Chaitra 22/ Chaitra 28 / April 11
9. Easter Sunday	First Sunday after the 14th day of the Moon (nearly Full Moon) occurring on or immediately after March 21	Chaitra 23 /Chaitra 29 /April 12
		Saka 1942 / Kali 5121/ 2020 A.D.
10. Low Sunday	7 days after Easter Sunday	Chaitra 30/ Vaisakha 6 /April 19

THE INDIAN LUNAR CALENDAR

TIME OF NEW MOON (IN I.S.T.) MARKING THE COMMENCEMENT OF LUNAR MONTHS

2003 (1924 - 25 S.E.)

		d	h	m
Pausha	Jan.	2	25	53
Magha	Feb.	1	16	19
Phalguna	Mar.	3	08	05
Chaitra	Apr.	1	24	48
Vaisakha	May	1	17	44
Jyaishtha	May	31	09	49
Ashadha	June	29	24	07
Sravana	July	29	12	21
Bhadra	Aug.	27	22	54
Asvina	Sept	26	08	37
Kartika	Oct.	25	18	19
Margasirsha	Nov.	23	28	28
Pausha	Dec.	23	15	13

2006 (1927 - 28 S.E.)

	d	h	m
		—	
Jan.	29	19	45
Feb.	27	30	01
Mar.	29	15	45
Apr.	27	25	14
May	27	10	56
June	25	21	35
July	25	10	01
Aug.	23	24	40
Sept.	22	17	15
Oct.	22	10	44
Nov.	20	27	48
Dec.	20	19	31

2009 (1930 - 31 S.E.)

	d	h	m
		—	
Jan.	26	13	25
Feb.	25	07	05
Mar.	26	21	36
Apr.	25	08	53
May	24	17	41
June	22	25	05
July	22	08	05
Aug.	20	15	32
Sept.	18	24	14
Oct.	18	11	03
Nov.	16	24	44
Dec.	17	17	32

2004 (1925 - 26 S.E.)

Pausha			---	
Magha	Jan.	21	26	35
Phalguna	Feb.	20	14	48
Chaitra	Mar.	20	28	11
Vaisakha	Apr.	19	18	51
Jyaishtha	May	19	10	22
Ashadha	June	17	29	57
Sravana	*July*	*17*	*16*	*54*
	Aug.	16	06	54
Bhadra	Sept.	14	19	59
Asvina	Oct.	14	08	18
Kartika	Nov.	12	19	57
Margasirsha	Dec	12	06	59
Pausha			---	

2007 (1928 - 29 S.E.)

		—	
Jan.	19	09	31
Feb.	17	21	44
Mar.	19	08	13
Apr.	17	17	06
May	*16*	*24*	*57*
June	15	08	43
July	14	17	34
Aug.	12	28	33
Sept.	11	18	14
Oct.	11	10	31
Nov.	9	28	33
Dec.	9	23	10

2010 (1931 - 32 S.E.)

Jan.	15	12	41
Feb.	14	08	21
Mar.	15	26	31
Apr.	*14*	*17*	*59*
May	14	06	34
June	12	16	45
July	11	25	10
Aug.	10	08	38
Sept.	8	16	00
Oct.	7	24	15
Nov.	6	10	22
Dec.	5	23	06

2005 (1926 - 27 S.E.)

Pausha	Jan.	10	17	33
Magha	Feb.	8	27	58
Phalguna	Mar.	10	14	40
Chaitra	Apr.	8	26	02
Vaisakha	May	8	14	15
Jyaishtha	June	6	27	25
Ashadha	July	6	17	33
Sravana	Aug.	5	08	35
Bhadra	Sept	3	24	15
Asvina	Oct.	3	15	58
Kartika	Nov.	2	06	55
Margasirsha	Dec.	1	20	31
Pausha	Dec.	31	08	42

2008 (1929 - 30 S.E.)

Jan.	8	17	17
Feb.	7	09	14
Mar.	7	22	44
Apr.	6	09	25
May	5	17	48
June	3	24	53
July	3	07	49
Aug.	1	15	43
Aug.	30	25	28
Sept.	29	13	42
Oct.	28	28	44
Nov.	27	22	25
Dec.	27	17	52

2011 (1932 - 33 S.E.)

Jan.	4	14	33
Feb.	3	08	01
Mar.	4	26	16
Apr.	3	20	02
May	3	12	21
June	1	26	33
July	1	14	24
July	30	24	10
Aug.	29	08	34
Sept.	27	16	39
Oct.	26	25	26
Nov.	25	11	40
Dec.	24	23	36

N.B.- The figures in the italics show the beginning of the intercalary (*mala or adhika*) month followed by the normal (*suddha or nija*) month of the same name.

THE INDIAN LUNAR CALENDAR

TIME OF NEW MOON (IN I.S.T.) MARKING THE COMMENCEMENT OF LUNAR MONTHS

	2012 (1933 - 34 S.E.)	d	h	m	2015 (1936 - 37 S.E.)	d	h	m	2018 (1939 - 40 S.E)	d	h	m	2021 (1942 - 43 S.E)	d	h	m
			---				---				---					
Pausha	Jan.	23	13	09	Jan.	20	18	44	Jan.	17	07	47	Jan.	13	10	30
Magha	Feb.	21	28	05	Feb.	18	29	17	Feb.	15	26	35	Feb.	11	24	36
Phalguna	Mar.	22	20	07	Mar.	20	15	06	Mar.	17	18	42	Mar.	13	15	51
Chaitra	Apr.	21	12	48	Apr.	18	24	27	Apr.	16	07	27	Apr.	12	08	01
Vaisakha													May	11	24	30
Jyaishtha	May	20	05	17	May	18	09	43	*May*	*15*	*17*	*18*	June	10	16	23
									June	13	25	13				
Ashadha	June	19	20	32	*June*	*16*	*19*	*35*	July	13	08	18	July	10	06	47
					July	16	06	54								
Sravana	July	19	09	54	Aug.	14	20	23	Aug.	11	15	28	Aug.	08	19	20
Bhadra	*Aug.*	*17*	*21*	*24*	Sept	13	12	11	Sept.	09	23	32	Sept.	07	06	22
	Sept.	16	07	41												
Asvina	Oct.	15	17	33	Oct.	12	29	36	Oct.	09	09	17	Oct.	06	16	35
Kartika	Nov.	13	27	38	Nov.	11	23	17	Nov.	07	21	32	Nov.	04	26	45
Margasirsha	Dec.	13	14	12	Dec.	11	15	59	Dec.	07	12	50	Dec.	04	13	13
Pausha			---				---				---				---	

	2013 (1934 - 35 S.E.)	d	h	m	2016 (1937 - 38 S.E.)	d	h	m	2019 (1940 - 41 S.E.)	d	h	m
Pausha	Jan.	11	25	14	Jan.	10	07	01	Jan.	6	06	58
Magha	Feb.	10	12	50	Feb.	8	20	09	Feb.	4	26	34
Phalguna	Mar.	11	25	21	Mar.	9	07	25	Mar.	6	21	34
Chaitra	Apr.	10	15	05	Apr.	7	16	54	Apr.	5	14	21
Vaisakha	May	10	05	58	May	6	25	00	May	4	28	16
Jyaishtha	June	8	21	26	June	5	08	30	June	3	15	32
Ashadha	July	8	12	44	July	4	16	31	July	2	24	46
Sravana	Aug.	6	27	21	Aug.	2	26	15	Aug.	1	08	42
Bhadra	Sept.	5	17	06	Sept.	1	14	33	Aug.	30	16	07
Asvina	Oct.	5	06	05	Sept.	30	29	41	Sept.	28	23	56
Kartika	Nov.	3	18	20	Oct.	30	23	08	Oct.	28	09	09
Margasirsha	Dec.	2	29	52	Nov.	29	17	48	Nov.	26	20	36
Pausha			---		Dec.	29	12	23	Dec.	26	10	43

	2014 (1935 - 36 S.E.)	d	h	m	2017 (1938 - 39 S.E.)	d	h	m	2020 (1941 - 42 S.E.)	d	h	m
Pausha	Jan.	1	16	44			---				---	
Magha	Jan..	30	27	09	Jan.	27	29	37	Jan.	24	27	12
Phalguna	Mar.	1	13	30	Feb.	26	20	28	Feb.	23	21	02
Chaitra	Mar.	30	24	15	Mar.	28	08	27	Mar.	24	14	58
Vaisakha	Apr.	29	11	44	Apr.	26	17	46	Apr.	23	07	56
Jyaishtha	May	28	24	10	May	25	25	14	May	22	23	09
Ashadha	June	27	13	39	June	24	08	01	June	21	12	11
Sravana	July	26	28	12	July	23	15	16	July	20	23	03
Bhadra	Aug.	25	19	43	Aug.	21	24	00	Aug.	19	08	12
Asvina	Sept.	24	11	44	Sept.	20	11	00	*Sept.*	*17*	*16*	*30*
									Oct.	16	25	01
Kartika	Oct.	23	27	27	Oct.	19	24	42	Nov.	15	10	37
Margasirsha	Nov.	22	18	02	Nov.	18	17	12	Dec.	14	21	47
Pausha	Dec.	22	07	06	Dec.	18	12	00			---	

N.B.- The figures in the italics show the beginning of the intercalary (*mala or adhika*) month followed by the normal (*suddha or nija*) month of the same name.

INDIAN CALENDAR
SAKA ERA 1942

Mesha : Madhava
Spring (Vasanta), 2nd Month
Ayanamsa on 1st : $24^0 08' 06''$

Month of CHAITRA (30 days)

(*Nirayana*) 7 Chaitra, 5120 Kali Era to (*Nirayana*) 7 Vaisakha, 5121 Kali Era

Date	Week Day	Gregorian Date		Tithi				Nakshatra			Yoga		
				No.		Ending Moment		No.	Ending Moment		No.	Ending Moment	
						h	m		h	m		h	m
		2020 A.D.											
1	Sat	Mar.	21	K	12	7	56.2	23	19	39.5	21	12	21.5
2	Sun		22		13	10	08.4	24	22	26.6	22	13	02.4
3	Mon		23		14	12	30.6	25	25	21.1	23	13	50.5
4	Tue		24	K	30	14	58.2	26	28	18.9	24	14	42.6
5	Wed		25	S	1	17	27.3	27	-	-	25	15	36.0
6	Thu		26		2	19	53.8	27	7	16.3	26	16	27.9
7	Fri		27		3	22	12.9	1	10	09.2	27	17	14.9
8	Sat		28		4	24	18.2	2	12	52.0	1	17	52.7
9	Sun		29	S	5	26	01.8	3	15	17.5	2	18	15.3
10	Mon		30		6	27	15.1	4	17	17.7	3	18	18.0
11	Tue		31		7	27	50.2	5	18	43.9	4	17	53.1
12	Wed	Apr.	1		8	27	40.6	6	19	29.0	5	16	55.5
13	Thu		2		9	26	43.4	7	19	28.3	6	15	21.4
14	Fri		3	S	10	24	58.7	8	18	40.5	7	13	09.2
15	Sat		4		11	22	30.4	9	17	08.1	8	10	19.9
16	Sun		5		12	19	25.3	10	14	57.1	9	6	57.3
											(10	27	07.1)
17	Mon		6		13	15	52.3	11	12	16.0	11	22	56.7
18	Tue		7		14	12	01.8	12	9	15.4	12	18	35.1
19	Wed		8	S	15	8	05.1	13	6	06.9	13	14	11.6
				(K	1	28	13.7)	(14	27	02.7)			
20	Thu		9		2	24	39.2	15	24	14.9	14	9	55.5
21	Fri		10		3	21	32.2	16	21	54.7	15	5	56.0
											(16	26	21.7)
22	Sat		11		4	19	02.1	17	20	11.5	17	23	19.3
23	Sun		12	K	5	17	16.2	18	19	12.7	18	20	53.9
24	Mon		13		6	16	19.1	19	19	02.3	19	19	07.9
25	Tue		14		7	16	11.8	20	19	40.7	20	18	01.3
26	Wed		15		8	16	51.8	21	21	04.1	21	17	31.2
27	Thu		16		9	18	12.0	22	23	05.6	22	17	32.5
28	Fri		17	K	10	20	04.1	23	25	35.7	23	17	58.2
29	Sat		18		11	22	17.9	24	28	24.6	24	18	41.0
30	Sun		19		12	24	43.4	25	-	-	25	19	33.8
31	Mon		20	K	13	27	12.3	25	7	22.8	26	20	30.4

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.
Moon enters :- Kumbha 1, $6^h 20^m.4$;Mina 3,$18^h 37^m.0$;Mesha 6, $7^h 16^m.3$;Vrisha 8, $19^h 30^m.3$;Mithuna 11,$6^h 05^m.5$; Karkata 13,$13^h 32^m.9$; Simha 15,$17^h 08^m.1$; Kanya 17, $17^h 32^m.2$; Tula 19,$16^h 33^m.6$; Vrischika 21, $16^h 26^m.6$; Dhanus 23, $19^h 12^m.7$;Makara 25, $25^h 57^m.6$;Kumbha 28, $12^h 17^m.7$; Mina 30, $24^h 37^m.8$; Sun enters :- Nirayana Mesha 24, $20^h 23^m.0$.

AYANAMSA, 2019-2020

TRUE AYANAMSA FOR $5^h\ 29^m.0$ I.S.T.

Date 2019	Ayanamsa °	′	″	Date 2019	Ayanamsa °	′	″	Date 2019	Ayanamsa °	′	″	Date 2019-20	Ayanamsa °	′	″
Jan. 1	24	07	06.0	May 1	24	07	20.3	Aug. 29	24	07	38.4	Dec. 27	24	07	53.9
4	24	07	06.6	4	24	07	20.4	Sept. 1	24	07	38.6	30	24	07	54.6
7	24	07	07.3	7	24	07	20.8	4	24	07	38.7	Jan. 2	24	07	54.9
10	24	07	07.8	10	24	07	21.5	7	24	07	39.1	5	24	07	55.2
13	24	07	08.1	13	24	07	22.0	10	24	07	39.6	8	24	07	55.7
16	24	07	08.4	16	24	07	22.2	13	24	07	39.9	11	24	07	56.6
19	24	07	09.1	19	24	07	22.6	16	24	07	39.9	14	24	07	57.2
22	24	07	09.9	22	24	07	23.2	19	24	07	39.9	17	24	07	57.4
25	24	07	10.2	25	24	07	23.9	22	24	07	40.4	20	24	07	57.8
28	24	07	10.4	28	24	07	24.2	25	24	07	40.9	23	24	07	58.6
31	24	07	10.9	31	24	07	24.4	28	24	07	41.1	26	24	07	59.2
Feb. 3	24	07	11.5	June 3	24	07	24.9	Oct. 1	24	07	41.1	29	24	07	59.5
6	24	07	12.0	6	24	07	25.7	4	24	07	41.5	Feb. 1	24	07	59.6
9	24	07	12.1	9	24	07	26.3	7	24	07	42.1	4	24	08	00.0
12	24	07	12.2	12	24	07	26.6	10	24	07	42.3	7	24	08	00.7
15	24	07	12.7	15	24	07	27.0	13	24	07	42.4	10	24	08	01.3
18	24	07	13.4	18	24	07	27.7	16	24	07	42.5	13	24	08	01.4
21	24	07	13.7	21	24	07	28.4	19	24	07	42.9	16	24	08	01.7
24	24	07	13.7	24	24	07	28.8	22	24	07	43.5	19	24	08	02.3
27	24	07	14.1	27	24	07	29.0	25	24	07	43.8	22	24	08	02.8
Mar. 2	24	07	14.6	30	24	07	29.5	28	24	07	43.9	25	24	08	02.9
5	24	07	14.9	July 3	24	07	30.3	31	24	07	44.3	28	24	08	03.0
8	24	07	15.0	6	24	07	31.0	Nov. 3	24	07	45.0	Mar. 3	24	08	03.3
11	24	07	15.0	9	24	07	31.3	6	24	07	45.4	6	24	08	03.9
14	24	07	15.3	12	24	07	31.6	9	24	07	45.6	9	24	08	04.3
17	24	07	15.9	15	24	07	32.3	12	24	07	45.8	12	24	08	04.3
20	24	07	16.2	18	24	07	33.0	15	24	07	46.3	15	24	08	04.6
23	24	07	16.2	21	24	07	33.3	18	24	07	47.1	18	24	08	05.1
26	24	07	16.5	24	24	07	33.5	21	24	07	47.5	21	24	08	05.5
29	24	07	17.0	27	24	07	33.8	24	24	07	47.7	24	24	08	05.6
Apr. 1	24	07	17.3	30	24	07	34.5	27	24	07	48.2	27	24	08	05.6
4	24	07	17.4	Aug. 2	24	07	35.2	30	24	07	49.0	30	24	08	05.8
7	24	07	17.4	5	24	07	35.4	Dec. 3	24	07	49.6	Apr. 2	24	08	06.4
10	24	07	17.7	8	24	07	35.6	6	24	07	49.9	5	24	08	06.8
13	24	07	18.3	11	24	07	36.2	9	24	07	50.2	8	24	08	06.9
16	24	07	18.7	14	24	07	36.8	12	24	07	50.8	11	24	08	07.1
19	24	07	18.8	17	24	07	37.1	15	24	07	51.7	14	24	08	07.7
22	24	07	19.1	20	24	07	37.1	18	24	07	52.3	17	24	08	08.2
25	24	07	19.6	23	24	07	37.3	21	24	07	52.6	20	24	08	08.3
28	24	07	20.1	26	24	07	37.8	24	24	07	53.1	23	24	08	08.4
May 1	24	07	20.3	Aug. 29	24	07	38.4	Dec. 27	24	07	53.9	Apr. 26	24	08	08.7

Mean Ayanamsa $= 23^0\ 51'\ 25''.53$ + precession in longitude from 2000.0 to date

$= 24^0\ 07'\ 21''.20$ + precession in longitude from 2019.0 to date

$= 24^0\ 08'\ 11''.46$ + precession in longitude from 2020.0 to date

True Ayanamsa = Mean Ayanamsa + Nutation in longitude

LONGITUDE OF SUN, MOON AND PLANETS, 2020

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date	Sun			Moon			Mercury			Venus			Mars			Jupiter			Saturn		
	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
Jan. 0	278	59	21	334	09	53	272	48	35	313	10	57	237	42	43	276	26	23	291	16	41
1	280	00	31	346	07	44	274	22	55	314	24	31	238	23	03	276	40	13	291	23	42
2	281	01	41	358	00	35	275	57	34	315	38	02	239	03	24	276	54	02	291	30	43
3	282	02	51	9	52	55	277	32	32	316	51	30	239	43	46	277	07	51	291	37	45
4	283	04	01	21	49	26	279	07	49	318	04	56	240	24	10	277	21	40	291	44	48
5	284	05	10	33	54	51	280	43	27	319	18	19	241	04	35	277	35	28	291	51	52
6	285	06	19	46	13	39	282	19	27	320	31	38	241	45	01	277	49	15	291	58	56
7	286	07	28	58	49	41	283	55	49	321	44	54	242	25	28	278	03	02	292	06	01
8	287	08	36	71	45	54	285	32	35	322	58	07	243	05	56	278	16	48	292	13	07
9	288	09	45	85	03	56	287	09	45	324	11	17	243	46	26	278	30	34	292	20	12
10	289	10	53	98	43	44	288	47	21	325	24	23	244	26	57	278	44	18	292	27	19
11	290	12	00	112	43	29	290	25	22	326	37	26	245	07	29	278	58	02	292	34	25
12	291	13	08	126	59	30	292	03	49	327	50	24	245	48	03	279	11	44	292	41	32
13	292	14	15	141	26	43	293	42	44	329	03	19	246	28	38	279	25	25	292	48	39
14	293	15	22	155	59	14	295	22	06	330	16	11	247	09	14	279	39	05	292	55	43
15	294	16	28	170	31	05	297	01	56	331	28	58	247	49	52	279	52	44	293	02	51
16	295	17	35	184	57	06	298	42	14	332	41	41	248	30	30	280	06	22	293	09	58
17	296	18	41	199	13	18	300	22	59	333	54	21	249	11	11	280	19	58	293	17	04
18	297	19	48	213	17	09	302	04	12	335	06	56	249	51	52	280	33	32	293	24	10
19	298	20	54	227	07	25	303	45	51	336	19	27	250	32	35	280	47	05	293	31	16
20	299	22	00	240	43	49	305	27	54	337	31	55	251	13	20	281	00	37	293	38	22
21	300	23	05	254	06	39	307	10	21	338	44	17	251	54	05	281	14	06	293	45	27
22	301	24	10	267	16	28	308	53	08	339	56	36	252	34	52	281	27	34	293	52	32
23	302	25	15	280	13	46	310	36	12	341	08	50	253	15	40	281	41	00	293	59	36
24	303	26	19	292	59	03	312	19	30	342	20	59	253	56	29	281	54	24	294	06	40
25	304	27	23	305	32	43	314	02	56	343	33	03	254	37	19	282	07	45	294	13	43
26	305	28	25	317	55	19	315	46	24	344	45	02	255	18	10	282	21	05	294	20	45
27	306	29	27	330	07	41	317	29	46	345	56	55	255	59	02	282	34	22	294	27	46
28	307	30	27	342	11	08	319	12	55	347	08	43	256	39	55	282	47	36	294	34	47
29	308	31	27	354	07	39	320	55	37	348	20	26	257	20	49	283	00	48	294	41	46
30	309	32	25	5	59	52	322	37	42	349	32	02	258	01	44	283	13	58	294	48	44
31	310	33	23	17	51	10	324	18	54	350	43	33	258	42	40	283	27	05	294	55	41

LONGITUDE OF SUN, MOON AND PLANETS, 2020

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date		Sun			Moon			Mercury			Venus			Mars			Jupiter			Saturn		
		°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
Feb.	1	311	34	19	29	45	34	325	58	54	351	54	57	259	23	37	283	40	08	295	02	37
	2	312	35	14	41	47	36	327	37	24	353	06	15	260	04	35	283	53	10	295	09	31
	3	313	36	07	54	02	07	329	13	58	354	17	26	260	45	35	284	06	08	295	16	24
	4	314	36	59	66	33	57	330	48	11	355	28	30	261	26	35	284	19	03	295	23	16
	5	315	37	50	79	27	31	332	19	32	356	39	27	262	07	36	284	31	55	295	30	06
	6	316	38	40	92	46	19	333	47	27	357	50	17	262	48	39	284	44	44	295	36	55
	7	317	39	28	106	32	07	335	11	19	359	01	00	263	29	42	284	57	30	295	43	43
	8	318	40	15	120	44	27	336	30	29	0	11	35	264	10	47	285	10	12	295	50	28
	9	319	41	00	135	19	59	337	44	14	1	22	02	264	51	53	285	22	51	295	57	12
	10	320	41	44	150	12	29	338	51	49	2	32	21	265	33	00	285	35	27	296	03	54
	11	321	42	27	165	13	28	339	52	30	3	42	31	266	14	08	285	47	58	296	10	34
	12	322	43	09	180	13	28	340	45	31	4	52	34	266	55	17	286	00	26	296	17	12
	13	323	43	49	195	03	34	341	30	10	6	02	28	267	36	28	286	12	51	296	23	48
	14	324	44	28	209	36	55	342	05	47	7	12	13	268	17	40	286	25	11	296	30	22
	15	325	45	06	223	49	19	342	31	47	8	21	50	268	58	53	286	37	28	296	36	54
	16	326	45	43	237	39	18	342	47	45	9	31	18	269	40	07	286	49	41	296	43	23
	17	327	46	19	251	07	34	342	53	23	10	40	37	270	21	22	287	01	49	296	49	51
	18	328	46	54	264	16	14	342	48	33	11	49	46	271	02	39	287	13	54	296	56	16
	19	329	47	28	277	08	05	342	33	24	12	58	46	271	43	56	287	25	54	297	02	39
	20	330	48	00	289	46	00	342	08	18	14	07	37	272	25	15	287	37	50	297	09	00
	21	331	48	31	302	12	31	341	33	50	15	16	17	273	06	34	287	49	41	297	15	18
	22	332	49	00	314	29	46	340	50	54	16	24	47	273	47	54	288	01	28	297	21	33
	23	333	49	28	326	39	21	340	00	38	17	33	06	274	29	15	288	13	10	297	27	46
	24	334	49	54	338	42	30	339	04	21	18	41	15	275	10	37	288	24	47	297	33	55
	25	335	50	19	350	40	23	338	03	34	19	49	12	275	51	59	288	36	19	297	40	02
	26	336	50	42	2	34	14	336	59	53	20	56	58	276	33	23	288	47	46	297	46	06
	27	337	51	02	14	25	41	335	54	57	22	04	31	277	14	47	288	59	07	297	52	07
	28	338	51	21	26	16	56	334	50	21	23	11	53	277	56	11	289	10	24	297	58	05
	29	339	51	39	38	10	53	333	47	35	24	19	02	278	37	37	289	21	36	298	04	00

LONGITUDE OF SUN, MOON AND PLANETS, 2020

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date		Sun			Moon			Mercury			Venus			Mars			Jupiter			Saturn		
		°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
Mar	1	340	51	54	50	11	12	332	47	59	25	25	58	279	19	03	289	32	42	298	09	52
	2	341	52	07	62	22	12	331	52	40	26	32	40	280	00	30	289	43	42	298	15	41
	3	342	52	18	74	48	40	331	02	34	27	39	09	280	41	57	289	54	37	298	21	27
	4	343	52	27	87	35	34	330	18	22	28	45	23	281	23	26	290	05	27	298	27	09
	5	344	52	34	100	47	26	329	40	34	29	51	23	282	04	55	290	16	10	298	32	48
	6	345	52	39	114	27	45	329	09	28	30	57	08	282	46	25	290	26	48	298	38	23
	7	346	52	42	128	37	56	328	45	10	32	02	37	283	27	56	290	37	20	298	43	55
	8	347	52	42	143	16	25	328	27	43	33	07	50	284	09	27	290	47	46	298	49	23
	9	348	52	41	158	18	01	328	16	59	34	12	46	284	50	59	290	58	05	298	54	48
	10	349	52	38	173	34	02	328	12	47	35	17	25	285	32	32	291	08	19	299	00	09
	11	350	52	32	188	53	19	328	14	53	36	21	47	286	14	06	291	18	26	299	05	26
	12	351	52	25	204	04	21	328	23	01	37	25	52	286	55	41	291	28	27	299	10	39
	13	352	52	16	218	57	14	328	36	52	38	29	38	287	37	16	291	38	21	299	15	49
	14	353	52	05	233	25	18	328	56	07	39	33	06	288	18	53	291	48	09	299	20	55
	15	354	51	53	247	25	32	329	20	29	40	36	14	289	00	30	291	57	50	299	25	57
	16	355	51	39	260	58	06	329	49	39	41	39	03	289	42	08	292	07	25	299	30	55
	17	356	51	24	274	05	29	330	23	18	42	41	32	290	23	47	292	16	53	299	35	49
	18	357	51	06	286	51	28	331	01	10	43	43	41	291	05	26	292	26	14	299	40	39
	19	358	50	47	299	20	15	331	42	59	44	45	28	291	47	06	292	35	27	299	45	24
	20	359	50	27	311	35	58	332	28	31	45	46	54	292	28	46	292	44	34	299	50	06
	21	0	50	04	323	42	14	333	17	31	46	47	56	293	10	27	292	53	33	299	54	43
	22	1	49	39	335	42	01	334	09	48	47	48	36	293	52	08	293	02	24	299	59	15
	23	2	49	13	347	37	35	335	05	08	48	48	52	294	33	49	293	11	08	300	03	43
	24	3	48	44	359	30	41	336	03	22	49	48	42	295	15	31	293	19	44	300	08	07
	25	4	48	14	11	22	41	337	04	20	50	48	08	295	57	12	293	28	13	300	12	26
	26	5	47	41	23	14	54	338	07	54	51	47	07	296	38	54	293	36	34	300	16	40
	27	6	47	07	35	08	46	339	13	54	52	45	38	297	20	36	293	44	46	300	20	50
	28	7	46	30	47	06	14	340	22	15	53	43	41	298	02	18	293	52	51	300	24	55
	29	8	45	51	59	09	49	341	32	49	54	41	15	298	43	60	294	00	48	300	28	56
	30	9	45	10	71	22	44	342	45	31	55	38	18	299	25	42	294	08	36	300	32	51
	31	10	44	26	83	48	53	344	00	15	56	34	50	300	07	24	294	16	16	300	36	42

LONGITUDE OF SUN, MOON AND PLANETS, 2020

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date		Sun			Moon			Mercury			Venus			Mars			Jupiter			Saturn		
		°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
Apr	1	11	43	40	96	32	36	345	16	58	57	30	49	300	49	06	294	23	48	300	40	28
	2	12	42	52	109	38	19	346	35	34	58	26	15	301	30	49	294	31	11	300	44	09
	3	13	42	02	123	09	53	347	56	01	59	21	05	302	12	31	294	38	26	300	47	45
	4	14	41	09	137	09	47	349	18	15	60	15	19	302	54	13	294	45	32	300	51	16
	5	15	40	14	151	38	07	350	42	13	61	08	55	303	35	55	294	52	29	300	54	42
	6	16	39	16	166	31	40	352	07	54	62	01	51	304	17	37	294	59	17	300	58	03
	7	17	38	17	181	43	35	353	35	15	62	54	07	304	59	19	295	05	56	301	01	19
	8	18	37	15	197	03	47	355	04	15	63	45	41	305	41	02	295	12	27	301	04	29
	9	19	36	11	212	20	41	356	34	53	64	36	32	306	22	44	295	18	48	301	07	35
	10	20	35	05	227	23	12	358	07	07	65	26	37	307	04	26	295	25	00	301	10	35
	11	21	33	58	242	02	46	359	40	57	66	15	57	307	46	09	295	31	03	301	13	30
	12	22	32	48	256	14	18	1	16	23	67	04	28	308	27	51	295	36	56	301	16	19
	13	23	31	37	269	56	22	2	53	24	67	52	10	309	09	33	295	42	40	301	19	04
	14	24	30	24	283	10	21	4	31	59	68	39	00	309	51	15	295	48	14	301	21	43
	15	25	29	10	295	59	39	6	12	10	69	24	57	310	32	57	295	53	39	301	24	16
	16	26	27	54	308	28	39	7	53	56	70	09	58	311	14	38	295	58	54	301	26	44
	17	27	26	36	320	42	05	9	37	17	70	54	03	311	56	18	296	03	59	301	29	07
	18	28	25	16	332	44	30	11	22	15	71	37	07	312	37	58	296	08	54	301	31	23
	19	29	23	55	344	39	58	13	08	48	72	19	10	313	19	37	296	13	39	301	33	35
	20	30	22	31	356	31	53	14	56	59	73	00	09	314	01	15	296	18	13	301	35	40

SUN AND MOON, 2020

DECLINATION OF SUN, LATITUDE AND DECLINATION OF MOON FOR 5^h $29^m.0$ I.S.T.

Date		Declination of Sun		Latitude of Moon		Declination of Moon		Date		Declination of Sun		Latitude of Moon		Declination of Moon	
		°	'	°	'	°	'			°	'	°	'	°	'
Jan.	0	-23	07.9	-4	22.5	-14	03.1	Feb.	1	-17	18.6	-4	49.5	+6	52.0
	1	23	03.5	4	53.6	9	58.7		2	17	01.6	4	18.9	11	15.7
	2	22	58.7	5	12.0	5	33.7		3	16	44.4	3	36.1	15	17.2
	3	22	53.4	5	17.0	-0	56.8		4	16	26.8	2	42.1	18	44.3
	4	22	47.7	5	08.5	+3	43.7		5	16	08.9	1	38.6	21	22.8
	5	22	41.5	4	46.3	8	19.6		6	15	50.8	-0	27.8	22	56.7
	6	22	34.9	4	10.7	12	41.1		7	15	32.3	+0	46.8	23	11.3
	7	22	27.8	3	22.3	16	36.2		8	15	13.7	2	00.8	21	57.2
	8	22	20.2	2	22.5	19	50.4		9	14	54.7	3	08.7	19	14.4
	9	22	12.3	-1	13.4	22	07.3		10	14	35.5	4	05.2	15	13.1
	10	22	03.9	+0	01.6	23	10.5		11	14	16.1	4	45.2	10	12.1
	11	21	55.0	1	18.3	22	48.5		12	13	56.4	5	05.6	+4	35.0
	12	21	45.8	2	31.5	20	57.9		13	13	36.5	5	05.3	-1	14.1
	13	21	36.1	3	36.0	17	45.5		14	13	16.4	4	45.1	6	53.1
	14	21	26.0	4	26.9	13	26.7		15	12	56.1	4	07.7	12	02.5
	15	21	15.5	5	00.6	8	21.6		16	12	35.5	3	16.7	16	26.4
	16	21	04.5	5	15.1	+2	51.2		17	12	14.7	2	15.9	19	51.9
	17	20	53.2	5	09.9	-2	44.4		18	11	53.8	1	09.3	22	09.5
	18	20	41.5	4	46.2	8	07.1		19	11	32.6	+0	00.6	23	14.0
	19	20	29.3	4	06.1	13	00.5		20	11	11.3	-1	06.7	23	04.9
	20	20	16.8	3	12.8	17	09.4		21	10	49.8	2	09.7	21	46.2
	21	20	03.9	2	09.7	20	20.6		22	10	28.1	3	05.7	19	26.4
	22	19	50.7	+1	00.8	22	23.8		23	10	06.3	3	52.4	16	16.0
	23	19	37.0	-0	10.2	23	12.7		24	9	44.3	4	28.2	12	26.6
	24	19	23.0	1	19.4	22	47.0		25	9	22.2	4	51.7	8	09.8
	25	19	08.7	2	23.6	21	12.1		26	8	59.9	5	02.4	-3	36.2
	26	18	54.0	3	20.0	18	37.7		27	8	37.5	5	00.0	+1	04.5
	27	18	38.9	4	06.3	15	15.8		28	8	14.9	4	44.7	5	43.0
	28	18	23.5	4	40.9	11	18.7		29	-7	52.3	-4	16.9	+10	10.5
	29	18	07.8	5	02.9	6	57.9								
	30	17	51.7	5	11.7	-2	23.3								
	31	-17	35.3	-5	07.2	+2	16.1								

SUN AND MOON, 2020

DECLINATION OF SUN, LATITUDE AND DECLINATION OF MOON FOR $5^h\ 29^m.0$ I.S.T.

Date		Declination of Sun		Latitude of Moon		Declination of Moon		Date		Declination of Sun		Latitude of Moon		Declination of Moon	
		°	'	°	'	°	'			°	'	°	'	°	'
Mar.	1	-7	29.5	-3	37.6	+14	17.5	Apr	1	+4	38.2	+0	20.2	+23	36.6
	2	7	06.6	2	47.9	17	53.3		2	5	01.3	1	28.2	23	27.2
	3	6	43.6	1	49.1	20	45.9		3	5	24.3	2	33.5	21	56.2
	4	6	20.5	-0	43.5	22	41.4		4	5	47.2	3	32.0	19	03.2
	5	5	57.4	+0	26.6	23	26.4		5	6	10.0	4	18.9	14	55.1
	6	5	34.1	1	37.4	22	49.4		6	6	32.7	4	49.8	9	45.8
	7	5	10.8	2	44.8	20	45.0		7	6	55.3	5	01.1	+3	55.1
	8	4	47.4	3	43.5	17	16.4		8	7	17.8	4	51.1	-2	13.1
	9	4	24.0	4	28.3	12	36.0		9	7	40.1	4	20.2	8	12.6
	10	4	00.5	4	54.8	7	03.9		10	8	02.3	3	31.7	13	38.0
	11	3	37.0	5	00.3	+1	04.7		11	8	24.4	2	30.0	18	07.0
	12	3	13.4	4	44.6	-4	55.4		12	8	46.3	1	20.8	21	23.2
	13	2	49.7	4	09.7	10	32.0		13	9	08.1	+0	08.9	23	17.3
	14	2	26.1	3	19.5	15	24.3		14	9	29.8	-1	01.1	23	47.8
	15	2	02.4	2	18.6	19	16.1		15	9	51.3	2	05.8	23	00.4
	16	1	38.7	1	11.7	21	56.2		16	10	12.6	3	02.8	21	04.9
	17	1	15.0	+0	02.9	23	19.5		17	10	33.7	3	50.1	18	13.4
	18	0	51.3	-1	04.1	23	26.1		18	10	54.7	4	26.4	14	38.1
	19	0	27.5	2	06.5	22	20.9		19	11	15.5	4	50.7	10	30.2
	20	-0	03.8	3	01.8	20	12.8		20	+11	36.1	-5	02.3	-6	00.0
	21	+0	19.9	3	48.0	17	12.1								
	22	0	43.6	4	23.5	13	30.0								
	23	1	07.3	4	47.2	9	17.6								
	24	1	30.9	4	58.3	4	45.3								
	25	1	54.5	4	56.3	-0	02.8								
	26	2	18.1	4	41.5	+4	40.2								
	27	2	41.6	4	14.4	9	14.2								
	28	3	05.1	3	35.9	13	29.2								
	29	3	28.5	2	47.3	17	14.8								
	30	3	51.8	1	50.3	20	19.3								
	31	+4	15.1	-0	47.0	+22	30.6								

PLANETS, 2020

GEOCENTRIC LATITUDE AND DECLINATION FOR $5^h\ 29^m.0$ I.S.T.

Date	Mercury		Venus		Mars		Jupiter		Saturn	
	Latitude	Declination	Latitude	Declination	Latitude	Declination	Latitude	Declination	Latitude	Declination
	° '	° '	° '	° '	° '	° '	° '	° '	° '	° '
Jan. 0	-1 11.0	-24 35.4	-1 50.8	-18 37.7	+0 22.3	-19 17.1	+0 05.4	-23 11.4	+0 03.2	-21 42.1
2	1 21.5	24 39.5	1 49.8	17 53.7	0 21.1	19 36.1	0 05.2	23 10.2	0 03.0	21 40.0
4	1 31.1	24 38.2	1 48.5	17 07.7	0 19.9	19 54.5	0 05.0	23 08.9	0 02.9	21 37.9
6	1 39.7	24 31.2	1 46.8	16 19.9	0 18.7	20 12.3	0 04.9	23 07.5	0 02.7	21 35.8
8	1 47.3	24 18.4	1 44.7	15 30.4	0 17.4	20 29.4	0 04.7	23 06.0	0 02.6	21 33.7
10	1 53.8	23 59.8	1 42.3	14 39.3	0 16.1	20 45.8	0 04.5	23 04.4	0 02.5	21 31.5
12	1 59.0	23 35.2	1 39.5	13 46.7	0 14.8	21 01.6	0 04.3	23 02.8	0 02.3	21 29.3
14	2 02.9	23 04.5	1 36.4	12 52.7	0 13.5	21 16.8	0 04.1	23 01.0	0 02.2	21 27.1
16	2 05.3	22 27.6	1 32.9	11 57.4	0 12.2	21 31.2	0 03.9	22 59.2	0 02.0	21 24.9
18	2 06.1	21 44.6	1 29.1	11 00.9	0 10.8	21 44.9	0 03.7	22 57.3	0 01.9	21 22.6
20	2 05.1	20 55.3	1 24.9	10 03.3	0 09.4	21 57.9	0 03.6	22 55.2	0 01.7	21 20.4
22	2 02.2	20 00.0	1 20.3	9 04.8	0 08.0	22 10.2	0 03.4	22 53.2	0 01.6	21 18.1
24	1 57.2	18 58.5	1 15.5	8 05.3	0 06.6	22 21.7	0 03.2	22 51.0	0 01.5	21 15.8
26	1 49.9	17 51.3	1 10.2	7 05.1	0 05.1	22 32.5	0 03.0	22 48.8	0 01.3	21 13.4
28	1 40.1	16 38.6	1 04.7	6 04.2	0 03.6	22 42.5	0 02.8	22 46.5	0 01.2	21 11.1
30	1 27.6	15 21.0	0 58.8	5 02.7	0 02.1	22 51.7	0 02.6	22 44.1	0 01.0	21 08.7
Feb. 1	1 12.2	13 59.3	0 52.6	4 00.7	+0 00.6	23 00.2	0 02.4	22 41.7	0 00.9	21 06.4
3	0 53.7	12 34.7	0 46.1	2 58.4	-0 01.0	23 07.8	0 02.2	22 39.2	0 00.7	21 04.0
5	0 32.1	11 08.7	0 39.3	1 55.8	0 02.5	23 14.7	0 02.1	22 36.6	0 00.6	21 01.7
7	-0 07.3	9 43.3	0 32.1	-0 53.0	0 04.2	23 20.7	0 01.9	22 34.0	0 00.5	20 59.3
9	+0 20.3	8 21.1	0 24.7	+0 09.9	0 05.8	23 26.0	0 01.7	22 31.3	0 00.3	20 56.9
11	0 50.4	7 05.2	0 17.1	1 12.8	0 07.5	23 30.4	0 01.5	22 28.6	0 00.2	20 54.6
13	1 22.2	5 58.9	0 09.1	2 15.5	0 09.1	23 34.0	0 01.3	22 25.8	+0 00.0	20 52.2
15	1 54.5	5 05.6	-0 01.0	3 18.1	0 10.9	23 36.8	0 01.1	22 23.0	-0 00.1	20 49.9
17	2 25.7	4 28.5	+0 07.4	4 20.4	0 12.6	23 38.8	0 00.9	22 20.2	0 00.3	20 47.6
19	2 54.1	4 09.8	0 16.1	5 22.3	0 14.4	23 39.9	0 00.7	22 17.3	0 00.4	20 45.2
21	3 17.6	4 10.7	0 24.9	6 23.7	0 16.2	23 40.2	0 00.5	22 14.4	0 00.6	20 42.9
23	3 34.2	4 30.4	0 33.9	7 24.6	0 18.0	23 39.6	0 00.3	22 11.5	0 00.7	20 40.6
25	3 42.5	5 06.2	0 43.1	8 24.9	0 19.9	23 38.3	+0 00.1	22 08.6	0 00.9	20 38.4
27	3 41.8	5 54.1	0 52.4	9 24.4	0 21.8	23 36.0	-0 00.1	22 05.6	0 01.0	20 36.1
29	+3 32.5	-6 48.8	+1 01.9	+10 23.2	-0 23.7	-23 33.0	-0 00.3	-22 02.7	-0 01.2	-20 33.9

PLANETS, 2020

GEOCENTRIC LATITUDE AND DECLINATION FOR $5^h\ 29^m.0$ I.S.T.

Date	Mercury				Venus				Mars				Jupiter				Saturn			
	Latitude		Declination		Latitude		Declination		Latitude		Declination		Latitude		Declination		Latitude		Declination	
	°	'	°		°	'	°	'	°	'	°	'	°	'	°	'	°	'	°	'
Feb. 29	+3	32.5	-6	48.8	+1	01.9	+10	23.2	-0	23.7	-23	33.0	-0	00.3	-22	02.7	-0	01.2	-20	33.9
Mar. 2	3	15.9	7	45.2	1	11.5	11	21.0	0	25.6	23	29.1	0	00.5	21	59.7	0	01.3	20	31.7
4	2	53.8	8	39.1	1	21.2	12	17.8	0	27.6	23	24.4	0	00.7	21	56.7	0	01.5	20	29.5
6	2	27.9	9	27.2	1	31.0	13	13.5	0	29.6	23	18.8	0	00.9	21	53.7	0	01.6	20	27.4
8	2	00.1	10	07.7	1	40.9	14	08.1	0	31.6	23	12.5	0	01.1	21	50.8	0	01.8	20	25.3
10	1	31.6	10	39.7	1	50.8	15	01.4	0	33.7	23	05.3	0	01.3	21	47.9	0	01.9	20	23.3
12	1	03.4	11	02.6	2	00.7	15	53.4	0	35.8	22	57.4	0	01.6	21	44.9	0	02.1	20	21.2
14	0	36.1	11	16.7	2	10.6	16	44.0	0	37.9	22	48.6	0	01.8	21	42.0	0	02.2	20	19.3
16	+0	10.3	11	22.3	2	20.4	17	33.2	0	40.0	22	39.0	0	02.0	21	39.2	0	02.4	20	17.3
18	-0	13.9	11	19.6	2	30.3	18	20.8	0	42.2	22	28.7	0	02.2	21	36.3	0	02.5	20	15.5
20	0	36.2	11	09.3	2	40.0	19	06.8	0	44.4	22	17.6	0	02.4	21	33.6	0	02.7	20	13.6
22	0	56.6	10	51.6	2	49.6	19	51.1	0	46.7	22	05.7	0	02.7	21	30.8	0	02.9	20	11.8
24	1	15.0	10	27.1	2	59.2	20	33.7	0	48.9	21	53.0	0	02.9	21	28.1	0	03.0	20	10.1
26	1	31.5	9	56.0	3	08.5	21	14.6	0	51.2	21	39.7	0	03.1	21	25.5	0	03.2	20	08.4
28	1	45.9	9	18.7	3	17.7	21	53.6	0	53.5	21	25.6	0	03.4	21	22.9	0	03.3	20	06.8
30	1	58.3	8	35.5	3	26.7	22	30.7	0	55.9	21	10.8	0	03.6	21	20.4	0	03.5	20	05.3
Apr. 1	2	08.8	7	46.7	3	35.4	23	05.8	0	58.3	20	55.2	0	03.9	21	18.0	0	03.7	20	03.8
3	2	17.2	6	52.5	3	43.9	23	39.0	1	00.7	20	39.0	0	04.1	21	15.6	0	03.8	20	02.4
5	2	23.7	5	53.1	3	52.0	24	10.2	1	03.1	20	22.2	0	04.3	21	13.4	0	04.0	20	01.0
7	2	28.2	4	48.8	3	59.8	24	39.3	1	05.6	20	04.7	0	04.6	21	11.2	0	04.2	19	59.8
9	2	30.7	3	39.8	4	07.2	25	06.4	1	08.1	19	46.5	0	04.9	21	09.1	0	04.3	19	58.6
11	2	31.1	2	26.2	4	14.2	25	31.4	1	10.6	19	27.7	0	05.1	21	07.1	0	04.5	19	57.4
13	2	29.6	-1	08.3	4	20.7	25	54.3	1	13.2	19	08.3	0	05.4	21	05.2	0	04.7	19	56.4
15	2	26.0	+0	13.7	4	26.6	26	15.1	1	15.7	18	48.3	0	05.6	21	03.5	0	04.8	19	55.4
17	2	20.3	1	39.6	4	32.0	26	33.8	1	18.3	18	27.8	0	05.9	21	01.8	0	05.0	19	54.5
19	2	12.7	3	09.2	4	36.7	26	50.4	1	21.0	18	06.7	0	06.2	21	00.2	0	05.2	19	53.7
21	-2	03.0	+4	42.0	+4	40.8	+27	04.9	-1	23.6	-17	45.0	-0	06.5	-20	58.8	-0	05.4	-19	53.0

URANUS, NEPTUNE AND PLUTO, 2020

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

Date	Uranus	Neptune	Pluto	Date	Uranus	Neptune	Pluto
	° ' "	° ' "	° ' "		° ' "	° ' "	° ' "
Jan. 0	32 42 12	346 14 44	292 21 10	Feb. 25	33 30 00	347 55 21	294 07 46
2	32 41 09	346 17 02	292 25 07	27	33 34 26	347 59 50	294 10 56
4	32 40 18	346 19 28	292 29 05	29	33 39 01	348 04 21	294 14 00
6	32 39 40	346 22 01	292 33 05	Mar. 2	33 43 46	348 08 53	294 17 00
8	32 39 14	346 24 42	292 37 05	4	33 48 40	348 13 25	294 19 54
10	32 39 01	346 27 29	292 41 07	6	33 53 42	348 17 59	294 22 44
12	32 39 01	346 30 22	292 45 09	8	33 58 52	348 22 32	294 25 28
14	32 39 13	346 33 22	292 49 10	10	34 04 10	348 27 05	294 28 07
16	32 39 37	346 36 28	292 53 11	12	34 09 36	348 31 38	294 30 40
18	32 40 14	346 39 41	292 57 13	14	34 15 09	348 36 11	294 33 07
20	32 41 03	346 42 59	293 01 13	16	34 20 49	348 40 43	294 35 28
22	32 42 06	346 46 23	293 05 14	18	34 26 36	348 45 15	294 37 44
24	32 43 21	346 49 53	293 09 13	20	34 32 30	348 49 45	294 39 53
26	32 44 48	346 53 28	293 13 11	22	34 38 29	348 54 14	294 41 56
28	32 46 27	346 57 09	293 17 08	24	34 44 35	348 58 41	294 43 52
30	32 48 19	347 00 54	293 21 03	26	34 50 46	349 03 06	294 45 42
Feb. 1	32 50 23	347 04 43	293 24 55	28	34 57 02	349 07 29	294 47 25
3	32 52 39	347 08 37	293 28 46	30	35 03 23	349 11 50	294 49 02
5	32 55 07	347 12 36	293 32 35	Apr. 1	35 09 49	349 16 08	294 50 32
7	32 57 47	347 16 39	293 36 21	3	35 16 19	349 20 24	294 51 56
9	33 00 38	347 20 45	293 40 04	5	35 22 52	349 24 36	294 53 12
11	33 03 41	347 24 54	293 43 44	7	35 29 29	349 28 45	294 54 22
13	33 06 54	347 29 07	293 47 21	9	35 36 09	349 32 51	294 55 24
15	33 10 19	347 33 23	293 50 55	11	35 42 52	349 36 53	294 56 20
17	33 13 54	347 37 42	293 54 25	13	35 49 38	349 40 51	294 57 08
19	33 17 40	347 42 04	293 57 52	15	35 56 26	349 44 45	294 57 50
21	33 21 37	347 46 28	294 01 14	17	36 03 16	349 48 35	294 58 25
23	33 25 43	347 50 54	294 04 33	19	36 10 07	349 52 20	294 58 52
25	33 30 00	347 55 21	294 07 46	21	36 17 00	349 56 01	294 59 12

EXPLANATION

In the following pages, a short explanation of the terms used in this Ephemeris has been given and the scope and limitations of the information furnished have been stated in a concise form. The values of the different constants and other data upon which the tabulated quantities are based have also been given in some cases in order to facilitate the use of this Ephemeris. It is not intended to furnish here any detailed explanation about the compilation of the tabular matter for which the reader is referred to the relevant literature.

Many changes have been incorporated in this publication from time to time including several recomendations of IAU at its General Assembly.

THE STANDARD EPOCH AND TIME SCALES

There are two classes of time scales used in Astronomy, one based on the Systeme International (SI) - the atomic second, the other based on the rotation of the Earth. Time scales based on the SI second include TAI and TT for practical applications. Time scale based on the rotation of the Earth include mean and apparent sidereal time and UT1. Because of irregularites in the Earth's rotation and its tidal deceleration, Earth's rotation based time scales do not advance at a uniform rate, and they increasingly lag behind the SI-second-based time scales. The widely disseminated time scale UTC is a hybrid, it advances by SI seconds but is subjct to one-second corrections (leap seconds) to keep it within $0^{s}.9$ of UT1.

The standard epoch J 2000.0 corresponds to 2000 January 1, 12^{h} TT (JD 245 1545.0 TT). A date may be expressed in years as a Julian epoch or for some purposes as a Besselian epoch.

Julian epoch = J [2000.0 + (JD − 245 1545.0)/ 365.25]
Where the quantity in the denominator is the Julian year.

Besselian epoch= B [1900.0 + (JD − 241 5020.313 52)/ 365.242 198 781]
Where the quantity in the denominator is the length of tropical year.

Prefixes J and B stand for the Julian and Besselian epochs respectively.

Various time systems used in this publication and their inter-relationships are described below :

Sidereal time system is derived from the Earth's rotation with respect to the stars. Local sidereal time is defined as the local hour angle of the vernal equinox. It is 0^{h} at the instant when the vernal equinox is at the upper transit of the local meridian. It is determined from observation of meridian transits of known stars. As the equinox oscillates about its mean position due to the effect of nutation, it gives rise to two kinds of sidereal time : the apparent sidereal time which is the hour angle of the true equinox of date and the mean sidereal time which is the hour angle of the mean equinox of date. The relation between the two is:

Apparent sidereal time = Mean sidereal time + Equation of Equinoxes

Equation of equinoxes is the total nutation in longitude multiplied by the cosine of the obliquity of the ecliptic. Its value varies within $\pm$ 1.2 seconds of time in a period of about 18.6 years.

Sidereal time on the geographic meridian of Greenwich is known as Greenwich sidereal time. Local sidereal time is related to Greenwich sidereal time (mean or apparent as appropriate) as follows:

Local sidereal time = Greenwich sidereal time + λ, where λ is the observer's longitude measured positively to the east (from 1985 onwards the sign convention for east terrestrial longitude to be positive has been adopted).

International Atomic Time (TAI) is a highly precise time scale given by atomic clocks. It is now being used as a standard in astronomy as it is independent of the Earth's rotation. Its fundamental unit, the SI second, is

defined as the duration of 9 192 631 770 cycles of the radiation corresponding to the transition between two hyperfine levels of the ground state of the Cesium 133 atom. This time scale results from analysis of data from atomic time standards of many countries carried out at the Bureau International de l ' Heure in Paris.

Universal Time (UT) is used for civil time keeping. It is an outgrowth of the mean solar time system derived from the Earth's rotation with respect to the Sun. It has been formally defined through a strict relationship with the Greenwich mean sidereal time and is, therefore, determined from observation of star transits. The universal time directly derived from observation is designated UT_o. It contains nonuniformities due to variations in the rotation of the Earth and is peculiar to the observer's geographic location because of polar motion. When UT_o is corrected for Earth's polar motion, it is called UT1. When UT1 is further corrected for seasonal variation in the Earth's rotation, it is called UT2. Both UT_o and UT2 are not for general usage. Instead, the national time services provide what is known as co-ordinated universal time (UTC). It is a smoothed version of UT2 and differs from TAI by an integral number of seconds. It contains step adjustments of exactly one second (leap seconds) in order to keep it always within 0.90 seconds of UT1. Beginning with 1972, the step adjustments are usually inserted after the 60^{th} second of the last minute of December 31 or June 30. In this publication, UT1 has been used in computations relating to hour angles, etc., unless otherwise stated.

Dynamical Time replaces ephemeris time (ET) as argument of ephemerides with effect from 1985 in this publication. The concept of different dynamical times for observers in different frames of reference arises out of general theory of relativity. In this publication, terrestrial time (TT) is the tabular argument of the fundamental geocentric ephemerides and barycentric dynamical time (TDB) is the arguments of ephemerides referred to the barycentre of the solar system. The former corresponds to proper time and the latter to co-ordinate time in terms of the general theory of relativity. Both TT and TDB are independent of the Earth's rotation. These scales are so defined that the difference between them is purely periodic. Their difference is given by:-

$\mathrm{TDB} = \mathrm{TT} + 0^s.001\,657 \sin g + 0^s.000\,067 \sin(L - L_J)$, where higher order terms have been neglected. Here g is the mean anomaly of the Earth in its orbit around the Sun and is given by:-

$$g = 357^\circ.53 + 0^\circ.985\,600\,28\,(\mathrm{JD} - 245\,1545.0)$$
$$L - L_J = 246^\circ.11 + 0.902\,517\,92\,(\mathrm{JD} - 245\,1545.0)$$

Where $L - L_J$ is the difference in the mean longitude of the Sun and Jupiter.

Relationship Between universal time and sidereal time

Universal time is defined in terms of Greenwich mean sidereal time by:

$$\mathrm{GMST\ at\ } 0^h\ \mathrm{UT1} = 6^h\,41^m\,50^s.549\,377 + 864\,018\,4^s.704\,478\,T_u + 0^s.092\,772\,T_u^2 - 2^s.93\times10^{-8}\,T_u^3 - 1^s.997\times 10^{-6}\,T_u^4 - 2^s.5\times10^{-9}\,T_u^5$$

where T_u is the number of Julian centuries of 36525 days of universal time elapsed since 1 January, 2000,12^h UT (JD 245 154 5.0). In other words,

$$T_u = (\mathrm{JD} - 245\,1545.0)/\,36525$$

The above expression implies that the ratio of UT1 to GMST at the epoch J2000.0 is 0.997 269 566 329 084 and its inverse is 1.002 737 909 350 795.

The following relationship holds during 2019:

On day of year d at t^h UT1 GMST = $6^h.624\,9915 + 0^h.065\,709\,8245\,d + 1^h.002\,737\,91\,t$

where day of the year d is tabulated on pages 4 to 12.

In 2019 :

1 mean solar day = 1.002 737 909 35 mean sidereal days
= $24^h\ 03^m\ 56^s.555\ 37$ of mean sidereal time

1 mean sidereal day = 0.997 269 566 33 mean solar days
= $23^h\ 56^m\ 04^s.090\ 53$ of mean solar time

Conversion of local mean time to local sidereal time

Calculate local sidereal time at $15^h\ 54^m\ 42^s$ L.M.T. on 2019 January 1, for Delhi longitude,

$\lambda = 77^\circ\ 13'\ 00''$ East ($5^h\ 08^m\ 52^s$)

		h	m	s
1.	Universal time = Local mean time $-\lambda$	10	45	50
2.	Greenwich mean sidereal time at 0^h U.T. on January 1, 2019 (Page 13).	6	41	26.525
		h	m	s
3.	Add equivalent mean sidereal time for 10 45 50 (UT $\times$ 1.002 737 9093).	10	47	36.094
4.	Greenwich mean sidereal time at desired L.M.T.	17	29	2.619
5.	Add equation of equinoxes at UT=0^d. 45 (second order interpolation may be used).			-0.702
6.	Greenwich apparent sidereal time	17	29	1.916
7.	Add longitude (east positive)	5	08	52.000
8.	Local apparent sidereal time	22	37	53.916

For local mean sidereal time, the above process may be repeated by neglecting the equation of equinoxes.

Conversion of local sidereal time to local mean time

Calculate local mean time at $22^h\ 38^m\ 51^s.206$ local apparent sidereal time on 2019 January 1, for Delhi longitude, $\lambda = 77^\circ\ 13'\ 00''$ East ($5^h\ 08^m\ 52^s$)

		h	m	s
1.	Local apparent sidereal time	22	37	53.916
2.	Subtract longitude (east positive)	5	08	52.000
3.	Greenwich apparent sidereal time	17	29	1.916
4.	Subtract equation of equinox at 0^h U.T.			-0.707
5.	Greenwich mean sidereal time (provisional)	17	29	2.624
6.	Subtract Greenwich mean sidereal time at 0^h U.T.	6	41	26.525
7.	Mean sidereal time interval (provisional) M.S.T. (P)	10	47	36.098

EXPLANATION

7.	Mean sidereal time interval (provisional) M.S.T. (P)	10	47	36.098
8.	Mean time interval in days corresponding to (7) above = (M.S.T. (P) $\times$ 0.997 269 566) = $0^d.45$ (UT). Subtract the increment to equation of equinoxes for $0^d.45$ UT (using second order interpolation)	(-)		00.005
9.	Mean sidereal time	10	47	36.094
10.	Equivalent UT (MST $\times$ 0.997 269 566)	10	45	49.999
11.	Local mean time = UT + λ	15	54	41.999

The mean time from the local mean sidereal time may be worked out on similar lines as above by neglecting the equation of equinoxes.

Notation for time-scales and related quantities

UT1	Universal time (also UT); counted from 0^h (mid night); unit is second of mean solar time, affected by iregularities in the Earth's rate of rotation.
UT0	local approximation to universal time; not corrected for polar motion (rarely used).
GMST	Greenwich mean sidereal time; GHA of mean equinox of date.
GAST	Greenwich apparent sidereal time; GHA of true Eqinox of date.
TAI	international atomic time; unit is the SI second of geoid.
UTC	coordinated universal time; differs from TAI by an integral number of seconds, and is the basis of most radio time signals and national and/ or legal time systems.
ΔUT	= UT1 – UTC; increment to be applied to UTC to give UT1
TDB	barycentric dynamical time; used as time-scale of ephemerides, referred to the barycentre of the solar system.
T_{eph}	the independent variable of the equations of motion used by the JPL ephemerides, in particular DE405/LE405. T_{eph} and TDB may be considered to be equivalent.
TT	terrestrial time; used as time-scale of ephemerides for observations from the Earth's surface (geoid).
TT	= TAI + $32^s.184$.
ΔT	= TT – UT1; increment to be applied to UT1 to give TT.
	= TAI + $32^s.184$ – UT1
ΔAT	= TAI –UT1; increment to be applied to UTC to give TAI; an integral number of seconds.
ΔTT	= TT – UTC = ΔAT + $32^s.184$; increment to be applied to UTC to give TT.
UT1 - UT0	= – (x sin λ + y cosλ) tanϕ/15 where λ and ϕ are usual geodetic longitude and latitude of the place, and x and y are the co-ordinates of the pole with respect to the geodetic system, in arcseconds.
GAST	= GMST + $\varepsilon_\gamma/15$, ε_γ is equation of equinox.

In order to convert the tabulations for 0^h TT to 0^h UT, one may interpolate to $\Delta T\ \delta_{1/2}/h$ where h is the tabular interval and $\delta_{1/2}$ is the first difference of the tabular values.

REDUCTION OF TIME SCALES, 1620-1644

ΔT = ET - UT

Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT
	s		s		s		s		s
1620.0	+ 124	1625.0	+ 102	1630.0	+ 85	1635.0	+ 72	1640.0	+ 62
1621	119	1626	98	1631	82	1636	70	1641	60
1622	115	1627	95	1632	79	1637	67	1642	58
1623	110	1628	91	1633	77	1638	65	1643	57
1624	+ 106	1629	+ 88	1634	+ 74	1639	+ 63	1644	+ 55

REDUCTION OF TIME SCALES, 1645-1819

ΔT = ET - UT

Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT
	s		s		s		s		s
1645.0	+ 54	1680.0	+ 16	1715.0	+ 10	1750.0	+ 13	1785.0	+ 17
1646	53	1681	15	1716	10	1751	14	1786	17
1647	51	1682	14	1717	11	1752	14	1787	17
1648	50	1683	14	1718	11	1753	14	1788	17
1649	49	1684	13	1719	11	1754	14	1789	17
1650.0	+ 48	1685.0	+ 12	1720.0	+ 11	1755.0	+ 14	1790.0	+ 17
1651	47	1686	12	1721	11	1756	14	1791	17
1652	46	1687	11	1722	11	1757	14	1792	16
1653	45	1688	11	1723	11	1758	15	1793	16
1654	44	1689	10	1724	11	1759	15	1794	16
1655.0	+ 43	1690.0	+ 10	1725.0	+ 11	1760.0	+ 15	1795.0	+ 16
1656	42	1691	10	1726	11	1761	15	1796	15
1657	41	1692	9	1727	11	1762	15	1797	15
1658	40	1693	9	1728	11	1763	15	1798	14
1659	38	1694	9	1729	11	1764	15	1799	14
1660.0	+ 37	1695.0	+ 9	1730.0	+ 11	1765.0	+ 16	1800.0	+ 13.7
1661	36	1696	9	1731	11	1766	16	1801	13.4
1662	35	1697	9	1732	11	1767	16	1802	13.1
1663	34	1698	9	1733	11	1768	16	1803	12.9
1664	33	1699	9	1734	12	1769	16	1804	12.7
1665.0	+ 32	1700.0	+ 9	1735.0	+ 12	1770.0	+ 16	1805.0	+ 12.6
1666	31	1701	9	1736	12	1771	16	1806	12.5
1667	30	1702	9	1737	12	1772	16	1807	12.5
1668	28	1703	9	1738	12	1773	16	1808	12.5
1669	27	1704	9	1739	12	1774	16	1809	12.5
1670.0	+ 26	1705.0	+ 9	1740.0	+ 12	1775.0	+ 17	1810.0	+ 12.5
1671	25	1706	9	1741	12	1776	17	1811	12.5
1672	24	1707	9	1742	12	1777	17	1812	12.5
1673	23	1708	10	1743	12	1778	17	1813	12.5
1674	22	1709	10	1744	13	1779	17	1814	12.5
1675.0	+ 21	1710.0	+ 10	1745.0	+ 13	1780.0	+ 17	1815.0	+ 12.5
1676	20	1711	10	1746	13	1781	17	1816	12.5
1677	19	1712	10	1747	13	1782	17	1817	12.4
1678	18	1713	10	1748	13	1783	17	1818	12.3
1679	+ 17	1714	+ 10	1749	+ 13	1784	+ 17	1819	+ 12.2

This table is based on an adopted value of $-26''/\mathrm{cy}^2$ for the tidal term ($\dot{n}$) in the mean motion of the Moon from the results of analyses of observations of lunar occultations of stars, eclipses of the Sun and transits of Mercury. (see F.R. Stephenson and L.V. Morrison, 1984 *PhD* Trans, R, Soc. London, Ser A, 313, 47-70).

To calculate the values of ΔT for a different value of the tidal term ($\dot{n}'$), add $-0.000\,091\,(\dot{n}' + 26)\,(\text{year} - 1955)^2$ seconds to the tabulated values of ΔT.

REDUCTION OF TIME SCALES FROM 1820

1820 - 1983, ΔT = ET − UT.

From 1984, ΔT = TDT - UT.
2001, ΔT = TT - UT.

Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT	Year	ΔT
	s		s		s		s		s
1820.0	+ 12.0	1860.0	+ 7.88	1900.0	− 2.72	1940.0	+ 24.33	1980.0	+ 50.54
1821	11.7	1861	7.82	1901	1.54	1941	24.83	1981	51.38
1822	11.4	1862	7.54	1902	− 0.02	1942	25.30	1982	52.17
1823	11.1	1863	6.97	1903	+ 1.24	1943	25.70	1983	52.96
1824	10.6	1864	6.40	1904	2.64	1944	26.24	1984	53.79
1825.0	+ 10.2	1865.0	+ 6.02	1905.0	+ 3.86	1945.0	+ 26.77	1985.0	+ 54.34
1826	9.6	1866	5.41	1906	5.37	1946	27.28	1986	54.87
1827	9.1	1867	4.10	1907	6.14	1947	27.78	1987	55.32
1828	8.6	1868	2.92	1908	7.75	1948	28.25	1988	55.82
1829	8.0	1869	1.82	1909	9.13	1949	28.71	1989	56.30
1830.0	+ 7.5	1870.0	+ 1.61	1910.0	+ 10.46	1950.0	+ 29.15	1990.0	+ 56.86
1831	7.0	1871	+ 0.10	1911	11.53	1951	29.57	1991	57.57
1832	6.6	1872	− 1.02	1912	13.36	1952	29.97	1992	58.31
1833	6.3	1873	1.28	1913	14.65	1953	30.36	1993	58.12
1834	6.0	1874	2.69	1914	16.01	1954	30.72	1994	59.98
1835.0	+ 5.8	1875.0	− 3.24	1915.0	+ 17.20	1955.0	+ 31.07	1995.0	+ 60.78
1836	5.7	1876	3.64	1916	18.24	1956	31.35	1996	61.63
1837	5.6	1877	4.54	1917	19.06	1957	31.68	1997	62.29
1838	5.6	1878	4.71	1918	20.25	1958	32.18	1998	62.97
1839	5.6	1879	5.11	1919	20.95	1959	32.68	1999	63.47
1840.0	+ 5.7	1880.0	− 5.40	1920.0	+ 21.16	1960.0	+ 33.15	2000.0	+ 63.83
1841	5.8	1881	5.42	1921	22.25	1961	33.59	2001	64.09
1842	5.9	1882	5.20	1922	22.41	1962	34.00	2002	64.30
1843	6.1	1883	5.46	1923	23.03	1963	34.47	2003	64.47
1844	6.2	1884	5.46	1924	23.49	1964	35.03	2004	64.57
								2005	+ 64.69
1845.0	+ 6.3	1885.0	− 5.79	1925.0	+ 23.62	1965.0	+ 35.73	2006	+ 64.85
1846	6.5	1886	5.63	1926	23.86	1966	36.54	2007	+ 65.15
1847	6.6	1887	5.64	1927	24.49	1967	37.43	2008	+ 65.46
1848	6.8	1888	5.80	1928	24.34	1968	38.29	2009	+ 65.78
1849	6.9	1889	5.66	1929	24.08	1969	39.20	2010	+ 66.07
								2011	+ 66.32
1850.0	+ 7.1	1890.0	− 5.87	1930.0	+ 24.02	1970.0	+ 40.18	2012	+ 66.60
1851	7.2	1891	6.01	1931	24.00	1971	41.17	2013	+ 66.91
1852	7.3	1892	6.19	1932	23.87	1972	42.23	2014	+ 67.28
1853	7.4	1893	6.64	1933	23.95	1973	43.37	2015	+ 67.64
1854	7.5	1894	6.44	1934	23.86	1974	44.49	2016	+ 68.10
								Extrapolated Values	
1855.0	+ 7.6	1895.0	− 6.47	1935.0	+ 23.93	1975.0	+ 45.48	2017	+ 68.59
1856	7.7	1896	6.09	1936	23.73	1976	46.46	2018	+ 69.0
1857	7.7	1897	5.76	1937	23.92	1977	47.52	2019	+ 69
1858	7.8	1898	4.66	1938	23.96	1978	48.53	2020	+ 70
1859	7.8	1899	3.74	1939	24.02	1979	49.59	2021	+ 70

Difference TAI – UTC = ΔAT

Date	ΔAT s	Date	ΔAT s	Date	ΔAT s	Date	ΔAT s
1972 Jul.1		1979 Jan.1		1990 Jan.1		1999 Jan. 1	
	+ 11.00		+ 18.00		+ 25.00		+ 32.00
1973 Jan.1		1980 Jan.1		1991 Jan.1		2006 Jan. 1	
	+ 12.00		+ 19.00		+ 26.00		+ 33.00
1974 Jan.1		1981 Jul.1		1992 Jul.1		2009 Jan. 1	
	+ 13.00		+ 20.00		+ 27. 00		+ 34.00
1975 Jan.1		1982 Jul.1		1993 Jul.1		2012 Jul. 1	
	+ 14.00		+ 21.00		+ 28.00		+ 35.00
1976 Jan.1		1983 Jul.1		1994 Jul.1		2015 Jul. 1	
	+ 15.00		+ 22.00		+ 29.00		+ 36.00
1977 Jan.1		1985 Jul.1		1996 Jan.1		2017 Jan. 1	
	+ 16.00		+ 23.00		+ 30.00		+ 37.00
1978 Jan.1		1988 Jan.1		1997 Jul.1		In critical cases descend	
	+ 17.00		+ 24.00		+ 31.00	ΔET	
1979 Jan.1		1990 Jan.1		1999 Jan.1		= ΔAT + $32^s.184$	
						ΔTT	

From 1990 onwards, ΔT is for Jan. 1 0^h UTC.

See page 2 for a summary of the notation for time-scales.

Astronomical Reference System and Reference Frames

A reference system is the complete specification of how a celestial coordinate system is to be formed. Both the origin and the orientation of the fundamental planes (or axes) are defined. A reference system also incorporates a specification of the fundamental models needed to construct the system; that is, the basis for the algorithms used to transform between observable quantities and reference data in the system. A reference frame, on the other hand, consists of a set of identifiable fiducial points on the sky along with their coordinates, which serves as the practical realization of a reference system.

For example, the fundamental plane of an astronomical reference system has conventionally been the extension of the Earth's equatorial plane, at some date, to infinity. Declination is the angular distance north or south of this plane, and right ascension is the angular distance measured eastward along the equator from some defined reference point. This reference point, the right asscension origin, has traditionally been the Equinox: the point at which the Sun, in its yearly circuit of the celestial sphere, crosses the equatorial plane moving from south to north. The Sun's apparent yearly motion lies in the ecliptic, the plane of the Earth's orbit. The equinox, therefore, is a direction in the space along the nodal line defined by the intersection of the ecliptic and equatorial planes; equivalently, on the celestial sphere, the equinox is at one of the two intersections of the great circles representing these planes. Because both of these planes are moving, the coordinate systems that they define must have a date associated with them; such a reference system must therefore be specified as "the equator and equinox of (some date)".

Of course, such a reference system is an idealization, because the theories of motion of the Earth that define how the two planes move are imperfect. In fact, the very definations of these planes are problematic for high precession work. Even if the fundamental planes of a reference system are defined without any reference to the motions of the Earth, there is no way magically to paint them on the celestial sphere at any particular time. Therefore, in practice, we use a specific reference frame - a set of fiducial objects with assigned coordinates - as the practical representation of an astronomical reference system. The scheme is completely analogous to how terrestrial reference systems are established using survey control stations (geodetic reference point) on the Earth's surface.

Most commonly, a reference frame consists of a catalog of precise positions (and motions, if measurable) of stars or extragalactic objects as seen from the solar system barycenter at a specific epoch (now usually "J2000.0", which is 12h TT on January 2000). Each object's instantaneous position, expressed as right ascension and declination, indicates the object's angular distance from the catalog's equator and origin of right ascension. Any two such objects in the catalog (if they are not coicident or antipodal) therefore uniquely orient a spherical coordinate system on the sky - a reference frame.

EXPLANATION

A modern astrometric catalog contains data on a large number of objects (N), so the coordinate system is vastly overdetermined. The quality of the reference frame defined by a catalog depends on the extent to which the coordinates of all possible pairs of objects ($N^2/2$) serve to the identical equator and right ascesion origin, within the expected random errors. Typically, every catalog contains systematic errors, that is, errors in position that are similar for objects that are in the same area of the sky, or are of the same magnitude (flux) or color (spectral index). Systematic errors mean that the reference frame is warped, or is effectively different for different classes of objects. Obviously, minimizing systematic errors when a catalog is constructed is at least as important as minimizing the random errors.

To be useful, a reference frame must be implemented at the time of actual observations, and this requires the computation of the apparent coordinates of the catalog objects at arbitrary dates and times. The accuracy with which we know the motions of the objects accross the sky is an essential factor in this computation. Astrometric star catalogs list proper motions, which are the projection of each star's space motion onto the celestial sphere, expressed as an angular rate in right ascension and declination per unit time. Because the tabulated proper motions are never perfect, any celesial reference frame deteriorates with time. Moreover, systematic errors in the proper motions can produce time-dependent warpings and spurious rotations of the frame. Therefore, the accuracy and consistency of the proper motions are critical to the overall quality, utility, and longevity of reference frames defined by stars. Even reference frames defined by extragalactic objects, which are usually considered to have zero proper motion, may deteriorate, because many of these objects show small apparent motions that are artifacts of their emission mechanisms.

The position of solar system objects can also be used to define a reference frame. For each solar system body involved, an ephemeris is used, which is simply a table of the celestial coordinates of the body as a funtion of time (or an algorithm that yields such a table). A reference frame defined by the ephemerides of one or more solar system bodies is called a dynamical reference frame. Because the ephemerides used incorporate the motion of the Earth as well as that of the other solar system bodies, dynamical reference frames embody in a very fundamental way the moving equator and ecliptic, hence the equinox. They have therefore been used to correct the orientation of star catalog reference frames (the star positions were systematically adjusted) on the basis of simultaneous observations of star and planets. In a sense, the solar system is used as a gyrocompass. However, dynamical reference frames are not very practical for establishing a coordinate system for day to day astronomical observations.

Descriptions of reference frames and reference systems often refer to three coordinate axes, which are simply the set of right-handed cartesian axes that correspond to the usual celestial spherical coordinate system. The xy-plane is the equator, the z-axis points toward the north celestial pole, and the x-axis points toward the origin of right ascension. Although in principal this allows us to specify the position of any celestial object in rectangular coordinates, the distance scale (based on stellar parallaxes) is not established to high precession beyond the solar system. What a reference system actually defines is the way in which the two coventional astronomical angular coordinates, right ascension and declination, overlay real observable points in the sky.

The fundamental celestial reference system for astronomical application is now the International Celestial Reference System (ICRS) as provided in resolution B2 of 1997. The "realization" of of the ICRS, called the International Celestial Reference Frame (ICRF), is a set of high accuracy positions of extragalactic radio sources measured by very long baseline interferometry.

The IAU Working Group on nomenclature for Fundamental Astronomy has recomended the following definations for ICRS and ICRF:

International Celestial Reference System (ICRS): The idealized barycetric co-ordinate system to which celestial positions are referred. It is kinematically non-rotating with respect to the ensemble of distant extragalactic objects. It has no intrinsic orientation but was aligned close to the mean equator and dynamical equinox of J2000.0 for continuity with previous fundamental reference systems. Its orientation is independent of epoch, ecliptic or equator and is realized by a list of adopted coordinates of extragalactic sources.

International Celestial Reference Frame (ICRF): A set of extragalactic objects whose adopted positions and uncertainties realize the ICRS axes and give the uncertainties of the axes. It is also the name of radio catalogue whose 212 defining sources are currently the most accurate realization of the ICRS. The orientation of the ICRF catalogue was carried over from earlier IERS radio catalogs and was within the errors of the standard stellar and dynamical frames at the time of adoption. Successive revision of the ICRF are intended to minimize rotation from its original orientation.

Some important reference systems and their designations as per IAU 2000 resolution B1.6, B1.7 and B1.8, and IAU 2006 resolutions 1 and 2 are listed below:

(i) Barycentric Celestial Reference System (BCRS): a system of barycentric space-time coordinates for the solar system within the framework of General Relativity. For all practical applications, the BCRS is assumed to be oriented according to the ICRS axes, the directions of which are realized by the International Celestial Reference Frame. The ICRS is not identical to the system defined by the dynamical mean equator and equinox of J2000.0, although the difference in orientation is only about $0''.02$.

(ii) The Geocentric Celestial Reference System (GCRS): is a system of geocentric space-time coordinates within the framework of General Relativity. The directions of the GCRS axes are obtained from those of the BCRS (ICRS) by a relativistic transformation. Positions of stars obtained from ICRS reference data, corrected for proper motion, parallax, light-bending, and aberration (for a geocentric observer) are with respect to the GCRS. The same is true for planetary positions, although the corrections are somewhat different.

(iii) The J2000.0 dynamical reference system: mean equator and equinox of J2000.0; a geocentric system where the origin of right ascension is the intersection of the mean ecliptic and equator of J2000.0; the system in which the IAU 2000 precession-nutation is defined. For precise applications a small rotation (frame bias) should be made to GCRS positions before precession and nutation are applied. The J2000.0 system may also be barycentric, for example as the reference system for catalogues.

(iv) The true system of date (t); true equator and equinox of date: a geocentric system of date, the pole of which is the celestial intermediate pole (CIP), with the origin of right ascension at the equinox on the true equator of date (intermediate equator). It is a system “between” the GCRS and the Terrestrial Intermediate Reference System that seperates the components labelled precession-nutation and polar motion.

(v) The Celestial Intermediate Reference System (i): the IAU recomended geocentric system of date, the pole of which is the celestial intermediate pole (CIP), with the origin of right ascension at the celestial intermediate origin (CIO) which is located on the intermediate equator (true equator of date). It is a system “between” (intermeiate) the GCRS and the Terrestrial Intermediate Reference System that seperates the components labelled precession-nutation and polar motion.

Precession and Nutation

The algorithms for precession were based on the IAU (1976) value for the rate of general precession in ecliptic longitude. Nutation was given by the 1980 IAU Theory of Nutation. However, IAU (1976) rate of precession had been overestimated by approximately 3 milliarcseconds per year. Further observations also revealed periodic errors of a few milliarcseconds in the 1980 IAU Theory of Nutation.

As part of the 2000 IAU resolutions, the IAU 2000A precession-nutation model was introduced, based on an updated value for the rate of precession and a completely new nutation theory. As before, the model actually consists of two parts, a precession algorithm describing the smooth secular motion of the celestial pole and a nutation algorithm describing the small periodic variations in the pole’s position. The precession algorithm consists of short polynomial series for the values of certain angles. The sines and cosines of these angles, in combination, then define the elements of a precession matrix, **P**. The nutation algorithm consists of a rather long series expansion in Fourier terms for the angular offsets, in ecliptic longitude and latitude, of the actual celestial pole (as modeled) from the precession-only pole (true pole - mean pole). The sines and cosines of these offsets, in combination, then define the elements of a nutation matrix, **N.** The **P** and **N** matrices are applied to the coordinates of celestial objects, expressed as 3-vectors, to transform them from the equator and equinox of one epoch to the equator and equinox of another.

EXPLANATION

A precession transformation is applied to celestial coordinates to convert them from the mean equator and equinox of J2000.0 to the mean equator and equinox of another date, t. Nutation is applied to the resulting coordinates to transform them to the true equator and equinox of t. Generally we will start with celestial coordinates in the GCRS, which are obtained from basic ICRS data by applying the usual algoriths for proper place. Therefore before we apply precession and nutation - we must first apply the frame bias correction to transform the GCRS coordinates to the dynamical mean equator and equinox of J2000.0. Schematically,

GCRS => frame bias = mean equator & equinox of J2000.0 = precession =>

mean equator & equinox of t = nutation => true equator & equinox of t.

The reduction from a geocentric position **r** with respect to the Geocentric Celestial Reference System (GCRS) to a position $\mathbf{r}_t$ with respect to equator and equinox of date, and vice versa, is given by;

$$\mathbf{r}_t = \mathbf{M}\,\mathbf{r} \quad \text{and} \quad \mathbf{r} = \mathbf{M}^{-1}\mathbf{r}_t$$

Using the 4-rotation Fukishma-Williams (F-W) method, the rotation matrix **M** may be witten as

$$\mathbf{M} = \mathbf{N\,P\,B}$$

Since the rotation to orient the GCRS to J2000.0 system are small the following approximate matrix **B** is called frame bias matrix, accurate to 2"x 10^{-9} (1 x 10^{-14} radians), may be used:

$$\mathbf{B} = \begin{bmatrix} 1 & d\alpha_0 & -\xi_0 \\ -d\alpha_0 & 1 & -\eta_0 \\ \xi_0 & \eta_0 & 1 \end{bmatrix}$$

where $d\alpha_0$ = -14.6 mas, ξ_0 = -16.6170 mas, and η_0 = -6.8192 mas, all converted to radians (divide by 206 264 806.247).

Precession

The time argument T is given by

$$T = (t - 2000.0)/100 = (JD_{TT} - 2451545.0)/36525, \text{ which is a function of TT.}$$

The Capitine *et al.* method, the formulation of which seperates precession of the equator from precession of the ecliptic, is via the precession angles χ_A, ω_A, ψ_A, which are

$$\psi_A = 5038''.481\,507\,T - 1''.079\,0069\,T^2 - 0''.001\,140\,45\,T^3 + 0''.000\,132\,851\,T^4 - 9''.51 \times 10^{-8}\,T^5$$

$$\omega_A = \varepsilon_0 - 0''.025\,754\,T + 0''.051\,2623\,T^2 - 0''.007\,725\,03\,T^3 - 0''.000\,000\,467\,T^4 + 33''.37 \times 10^{-8}\,T^5$$

$$\chi_A = 10''.556\,403\,T - 2''.381\,4292\,T^2 - 0''.001\,211\,97\,T^3 + 0''.000\,170\,663\,T^4 - 5''.60 \text{ X } 10\text{-}8\,T^5$$

The mean obliquity of the ecliptic at J2000.0 (or the equivalent TDB date) is $\varepsilon_0 = 84381''.406$

(i) A rotation from the mean equator and equinox of J2000.0 to the mean ecliptic and equinox of J2000.0. This is simply a rotation around the x-axis (the direction toward the mean equinox of J2000.0) by the angle ε_0 , the mean obliquity of J2000.0. After the rotation, the fundamental plane is the ecliptic of J2000.0

(ii) A rotation around the new z-axis (the direction toward the ecliptic pole of J2000.0) by the angle $-\psi_A$, the amount of precession of the equator from J2000.0 to t.

(iii) A rotation around the new x-axis (the direction along the intersection of the mean equator of t with the ecliptic of J2000.0) by the angle - ω_A, the obliquity of the mean equator of t with respect to the ecliptic of J2000.0. After the rotation, the fundamental plane is the mean equator of t.

(iv) A rotation around the new z-axis (the direction toward the mean celestial pole of t) by the angle χ_A, accounting for the precession of the ecliptic along the mean equator of t. After the rotation, the new x-axis is in the direction of the mean equinox of date.

$$\mathbf{P} = \begin{bmatrix} C_4C_2 - S_2S_4C_3 & C_4S_2C_1 + S_4C_3C_2C_1 - S_1S_4S_3 & C_4S_2S_1 + S_4C_3C_2S_1 + C_1S_4S_3 \\ -S_4C_2 - S_2C_4C_3 & -S_4S_2C_1 + C_4C_3C_2C_1 - S_1C_4S_3 & -S_4S_2S_1 + C_4C_3C_2S_1 + C_1C_4S_3 \\ S_2S_3 & -S_3C_2C_1 - S_1C_3 & -S_3C_2S_1 + C_3C_1 \end{bmatrix}$$

where $S_1 = \sin \varepsilon_0$ $\quad S_2 = \sin(-\psi_A)$ $\quad S_3 = \sin(-\omega_A)$ $\quad S_4 = \sin \chi_A$

$C_1 = \cos \varepsilon_0$ $\quad C_2 = \cos(-\psi_A)$ $\quad C_3 = \cos(-\omega_A)$ $\quad C_4 = \cos \chi_A$

Existing applications that use the 3-angle precession formulation of Newcomb and Lieske can be easily modified for the IAU 2000A precession, by replacing the current polynomials for the angles ζ_A, Z_A and θ_A with the following:

$$\zeta_A = 2''.650545 + 2306''.083227\,T + 0''.2988499\,T^2 + 0''.01801828\,T^3 - 0''.000005971\,T^4 - 0''.0000003173\,T^5$$

$$Z_A = -2''.650545 + 2306''.077181\,T + 1''.0927348\,T^2 + 0''.01826837\,T^3 - 0''.000028596\,T^4 - 0''.0000002904\,T^5$$

$$\theta_A = 2004''.191903\,T - 0''.4294934\,T^2 - 0''.04182264\,T^3 - 0''.000007089\,T^4 - 0''.0000001274\,T^5$$

The centennial (per Julian century) rates of general precession in right ascension and declination are given by :

$$m = 4612''.604\,08 + 2''.783\,169\,4\,T + 0''.108\,859\,95\,T^2 - 0''.000\,138\,268\,T^3 \text{ and}$$

$$n = 2004''.191\,903 - 0''.858\,986\,8\,T - 0''.125\,467\,92\,T^2 - 0''.000\,028\,356\,T^3$$

The elements of the matrix **P** given in terms of ζ_A, Z_A, θ_A are as follows:

$$\mathbf{P} = \begin{bmatrix} \cos\zeta_A \cos\theta_A \cos Z_A - \sin\zeta_A \sin Z_A & -\sin\zeta_A \cos\theta_A \cos Z_A - \cos\zeta_A \sin Z_A & -\sin\theta_A \cos Z_A \\ \cos\zeta_A \cos\theta_A \sin Z_A + \sin\zeta_A \cos Z_A & -\sin\zeta_A \cos\theta_A \sin Z_A + \cos\zeta_A \cos Z_A & -\sin\theta_A \sin Z_A \\ \cos\zeta_A \sin\theta_A & -\sin\zeta_A \sin\theta_A & \cos\theta_A \end{bmatrix}$$

The formula for reduction of precession in right ascension and declination are as follows :

$$\begin{aligned} \sin(\alpha - Z_A)\cos\delta &= \sin(\alpha_o + \zeta_A)\cos\delta_o. \\ \cos(\alpha - Z_A)\cos\delta &= \cos(\alpha_o + \zeta_A)\cos\theta_A \cos\delta_o - \sin\theta_A \sin\delta_o \\ \sin\delta &= \cos(\alpha_o + \zeta_A)\sin\theta_A \cos\delta_o + \cos\theta_A \sin\delta_o \end{aligned}$$

$$\begin{aligned} \sin(\alpha_o + \zeta_A)\cos\delta_o &= \sin(\alpha - Z_A)\cos\delta \\ \cos(\alpha_o + \zeta_A)\cos\delta_o &= \cos(\alpha - Z_A)\cos\theta_A \cos\delta + \sin\theta_A \sin\delta \\ \sin\delta_o &= -\cos(\alpha - Z_A)\sin\theta_A \cos\delta + \cos\theta_A \sin\delta \end{aligned}$$

Values of the angles ζ_A, Z_A, θ_A and of the elements of the matrix P for reduction from the standard epoch J 2000.0 to epoch of year are as follows:

Epoch J 2019.5 — Rotation matrix P for reduction to epoch J 2019.5

$$\zeta_A = +452''.348 = +0^\circ.125\,652$$
$$Z_A = +447''.076 = +0^\circ.124\,188$$
$$\theta_A = +390''.801 = +0^\circ.108\,556$$

$$\mathbf{P} = \begin{bmatrix} +0.999\,988\,70 & -0.004\,360\,52 & -0.001\,894\,65 \\ +0.004\,360.52 & +0.999\,990\,49 & -0.000\,004\,11 \\ +0.001\,894\,65 & -0.000\,004\,16 & +0.999\,998\,21 \end{bmatrix}$$

The obliquity of the ecliptic of date (with respect to the mean equator of date) is given by:

$$\varepsilon = \varepsilon_0 - 46''.836\,769 T - 0''.000\,183\,1\, T^2 + 0''.002\,003\,4\, T^3 - 0''.000\,000\,576\, T^4 - 0''.000\,000\,043\,4\, T^5$$

where $\varepsilon_0 = 84381''.406$

The precessional motion of the ecliptic specified by the inclination (π_A) and longitude of the node (Π_A) of the ecliptic of date with respect to the ecliptic and equinox of J 2000.0 are given by:

$$\text{Sin } \pi_A \sin \Pi_A = +4''.199\,094\, T + 0''.193\,987\, T^2 - 0''.000\,224\,66\, T^3$$
$$\text{Sin } \pi_A \cos \Pi_A = -46''.811\,015\, T + 0''.051\,028\, T^2 + 0''.000\,524\,13\, T^3$$

For epoch J 2019.5

$$\varepsilon = 23^\circ\,26'\,12''.27 = 23^\circ.436\,744$$
$$\pi_A = +9''.164 = 0^\circ.002\,5454$$
$$\Pi_A = 174^\circ\,49'.6 = 174^\circ.827$$

Approximate formulae for the reduction of precession in co-ordinates and orbital elements referred to the mean equinox and equator or ecliptic of date (t) are as follows :

Reduction to J 2000.0	Reduction from J 2000.0
$\alpha_o = \alpha - M - N \sin \alpha_m \tan \delta_m$	$\alpha = \alpha_o + M + N \sin \alpha_m \tan \delta_m$
$\delta_o = \delta - N \cos \alpha_m$	$\delta = \delta_o + N \cos \alpha_m$
$\lambda_o = \lambda - a + b \cos (\lambda + c') \tan \beta_o$	$\lambda = \lambda_o + a - b \cos (\lambda_o + c) \tan \beta$
$\beta_o = \beta - b \sin (\lambda + c')$	$\beta = \beta_o + b \sin (\lambda_o + c)$
$\Omega_o = \Omega - a + b \sin (\Omega + c') \cot i_o$.	$\Omega = \Omega_o + a - b \sin (\Omega_o + c) \cot i$
$i_o = i - b \cos (\Omega + c')$	$i = i_o + b \cos (\Omega_o + c)$
$\omega_o = \omega - b \sin (\Omega + c') \text{ cosec } i_o$	$\omega = \omega_o + b \sin (\Omega_o + c) \text{ cosec } i$

The precessional constants M, N etc. are given by :

$$M = 1^\circ.281\,155\,668\,9\, T + 0^\circ.000\,386\,551\,31\, T^2 + 0^\circ.000\,010\,079\, T^3$$
$$N = 0^\circ.556\,719\,973\,1\, T - 0^\circ.000\,119\,303\,72\, T^2 - 0^\circ.000\,011\,617\,4\, T^3$$
$$a = 1^\circ.396\,887\,83\, T + 0^\circ.000\,307\,065\,22\, T^2$$
$$b = 0^\circ.013\,055\,270\,3\, T - 0^\circ.000\,009\,303\,50\, T^2$$
$$c = 5^\circ.125\,890\,67 + 0^\circ.818\,993\,58\, T + 0^\circ.000\,104\,256\,09\, T^2 - 0^\circ.000\,104\,155\,607\, T^3$$
$$c' = 5^\circ.125\,890\,67 - 0^\circ.577\,894\,252\, T - 0^\circ.000\,164\,504\,28\, T^2 - 0^\circ.000\,104\,177\,728\, T^3$$

where $T = (t - 2000.0)/100 = (JD_{TT} - 245\,1545.0)/36525$

Formulae for the reduction from the mean equinox and equator or ecliptic of the middle of year (t_1) to date (t) are as follows :

$$\alpha = \alpha_1 + \tau\,(m + n \sin\alpha_1 \tan\delta_1) \qquad \delta = \delta_1 + \tau\, n \cos\alpha_1$$
$$\lambda = \lambda_1 + \tau\,\{p - \pi \cos(\lambda_1 + 6^\circ) \tan\beta\} \qquad \beta = \beta_1 + \tau\,\pi \sin(\lambda_1 + 6^\circ)$$
$$\Omega = \Omega_1 + \tau\,\{\rho - \pi \sin(\Omega_1 + 6^\circ) \cot i\} \qquad i = i_1 + \tau\,\pi \cos(\Omega_1 + 6^\circ)$$
$$\omega = \omega_1 + \tau\,\pi \sin(\Omega_1 + 6^\circ)\ \mathrm{cosec}\ i$$

where $\tau = t - t_1$ and π is the annual rate of rotation of the ecliptic. The precessional constants p, m, etc. are as follows :

		Epoch J 2019.5
Annual general precession	p =	$+\ 0^\circ.013\,970\,1$
Annual precession in R.A.	m =	$+\ 0^\circ.012\,813\,1$
Annual precession in Dec.	n =	$+\ 0^\circ.005\,566\,7$
Annual rate of rotation	π =	$+\ 0^\circ.000\,130\,5$
Longitude of axis	Π =	$+\ 174^\circ.8271$

$$\gamma = 180^\circ - \Pi = +\,5^\circ.1729$$

Where Π is the longitude of the instantaneous rotation axis of the ecliptic, measured from the mean equinox of date.

Nutation

The changes in the amplitudes of the nutation components are also not directly taken from the observations; instead a new nutation theory is developed and fit to observations by allowing a small number of geophysical constants to be free parameters. These parameters are constants in a “transfer function” that modifies the amplitudes of the terms from a rigid- Earth nutation development. Since there are fewer solved-for geophysical constants than the number of terms with observed amplitudes, the fit cannot be perfect. For the IAU 2000A model, 7 geophysical parameters were determined based on the observed amplitudes of 21 nutation terms (prograde and retrograde amplitudes for each) together with the apparent change in the rate of precession in longitude. Note that the number of free parameters in the model are both quite small compared to the 1365 terms in the new, full nutation serirs.

Nutation is conventionally expressed as two small angles, $\Delta\psi$ the nutation in longitude, and $\Delta\varepsilon$, the nutation in obliquity. These angles are measured in the Ecliptic system of date, which is developed as a part of precession formulation. The angle $\Delta\psi$ is the small change in the position of the equinox along the ecliptic due to nutation, so effect of nutation on the ecliptic coordinates of a fixed point in the sky is simply to add $\Delta\psi$ to its ecliptic longitude. The angle $\Delta\varepsilon$ is the small change in the obliquity of the ecliptic due to nutation. The true obliquity of date is $\varepsilon' = \varepsilon + \Delta\varepsilon$. Nutation in obliquity reflects the orientation of the equator in space and does not affect the ecliptic coordinates of a fixed point on the sky.

Formulas for Nutation

l	is the mean anomaly of the Moon.
l'	is the mean anomaly of the Sun (Earth).
Ω	is the longitude of the ascending node of the Moon’s mean orbit on the ecliptic, measured from the mean equinox of date.
D	is the mean elongation of the Moon from the Sun.
F	is the difference $L - \Omega$, where L is the mean longitude of the Moon.
ε	$= \varepsilon_0 - 46''.836\,769\,T - 0''.000\,183\,1\,T^2 + 0''.002\,003\,4\,T^3 - 0''.000\,000\,576\,T^4 - 0''.000\,000\,043\,4\,T^5$

where $\varepsilon_0 = 84381''.406$

EXPLANATION

The fundamental arguments are given by:

The five arguments are the same fundamental luni - solar arguments used in previous nutation theories, but with updated expressions.

l = 485 868''. 249 036 + (1325^r + 715 923''. 2178) T + 31''. 8792 T^2 + 0''. 051 635 T^3 - 0''.000 244 70 T^4

l' = 128 7104''. 793 04 + (99^r + 129 2581''. 048) T– 0''. 5532 T^2 – 0''. 000 136 T^3 - 0''.000 011 49 T^4

F = 335 779''. 526 232 + (1342^r + 295 262''. 8478) T – 12''. 7512 T^2 - 0''. 001 037 T^3 + 0''.000 004 17 T^4

D = 107 2260''. 703 69 + (1236^r + 110 5601''. 209) T – 6''. 3706 T^2 + 0''. 006 593 T^3 - 0''.000 031 69 T^4

Ω = 450 160''. 398 036 – (5^r + 482 890''. 5431) T + 7''. 722 T^2 + 0''. 007 702 T^3 - 0''.000 059 39 T^4

where 1^r = 360° = 129 6000''

Reduction for nutation - rigorous formulae

Nutation in longitude ($\Delta\psi$) and obliquity ($\Delta\varepsilon$) have been calculated using IAU 2000A series definitions (order of 1 µas) with the following adjustments which are required for use at the highest precession with the IAU 2006 precession, viz:

$$\Delta\psi = \Delta\psi_{2000A} + (0.4697 \times 10^{-6} - 2.7774 \times 10^{-6} T)\, \Delta\psi_{2000A}$$

$$\Delta\varepsilon = \Delta\varepsilon_{2000A} - 2.7774 \times 10^{-6}\, T\, \Delta\varepsilon_{2000A}$$

where T is measured in Julian centuries from 245 1545.0 TT. $\Delta\psi$ and $\Delta\varepsilon$ together with the true obliquity of the ecliptic (ε') are tabulated daily at 0^h TT, on page 18 to 32.

Once the nutation series has been evaluated and the values of $\Delta\psi$ and $\Delta\varepsilon$ are available, the nutation matrix can be constructed.

A mean place ($\mathbf{r}_m$) may be transformed to a true place ($\mathbf{r}_t$) and vice versa, as follows:

$$\mathbf{r}_t = \mathbf{N}\,\mathbf{r}_m \qquad \mathbf{r}_m = N^{-1}\,\mathbf{r}_t$$

where $\mathbf{N} = \mathbf{R}_1(-\varepsilon')\,\mathbf{R}_3(-\Delta\psi)\,\mathbf{R}_1(+\varepsilon)$

$\varepsilon' = \varepsilon + \Delta\varepsilon$

$\mathbf{R}_1$ and $\mathbf{R}_3$ are the standard rotations about the x and z axes respectively.

(i) A rotation from the mean equator and equinox of t to the mean ecliptic and equinox of t. This is simply a rotation around the x - axis (the direction toward the mean equinox of t) by the angle ε, the mean obliquity of t.

(ii) A rotation around the new z-axis (the direction toward the ecliptic pole of t) by the angle - $\Delta\psi$, the amount of nutation in longitude at t. After the rotation, the new x- axis is in the direction of true equinox of t.

(iii) A rotation around the new x-axis (the direction toward true equinox of t by the angle $-\varepsilon'$, the true oliquity of t. After the rotation, the fundamental plane is the true equator of t, orthogonal to the computed position of the CIP at t.

The nutation matrix can be written:

$$\mathbf{N} = \begin{bmatrix} C_2 & S_2C_1 & S_2S_1 \\ -S_2C_3 & C_3C_2C_1 - S_1S_3 & C_3C_2S_1 + C_1S_3 \\ S_2S_3 & -S_3C_2C_1 - S_1C_3 & -S_3C_2S_1 + C_3C_1 \end{bmatrix}$$

where $S_1 = \sin(\varepsilon)$ $\quad S_2 = \sin(-\Delta\psi)$ $\quad S_3 = \sin(-\varepsilon - \Delta\varepsilon)$

$C_1 = \cos(\varepsilon)$ $\quad C_2 = \cos(-\Delta\psi)$ $\quad C_3 = \cos(-\varepsilon - \Delta\varepsilon)$

Approximate reduction for nutation for converting mean place to true place can be done with the help of the following formulae :

$$\Delta\alpha = (\cos\varepsilon + \sin\varepsilon \sin\alpha \tan\delta)\,\Delta\psi - \cos\alpha \tan\delta\,\Delta\varepsilon$$

$$\Delta\delta = \sin\varepsilon \cos\alpha\,\Delta\psi + \sin\alpha\,\Delta\varepsilon$$

$$\Delta\lambda = \Delta\psi; \qquad \Delta\beta = 0$$

where $\Delta\psi$ and $\Delta\varepsilon$ are nutations in longitude and obliquity respectively. Mean rectangular coordinates (x, y, z) can be converted to true rectangular co-ordinates with the help of the following :

$$\Delta x = -(y \cos\varepsilon + z \sin\varepsilon)\,\Delta\psi$$
$$\Delta y = +\,x\,\Delta\psi \cos\varepsilon \;-\; z\,\Delta\varepsilon$$
$$\Delta z = +\,x\,\Delta\psi \sin\varepsilon \;+\; y\,\Delta\varepsilon$$

where both $\Delta\psi$ and $\Delta\varepsilon$ are in radians.

The elements of the corresponding rotation matrix are:

$$\mathbf{N} = \begin{bmatrix} 1 & -\Delta\psi\cos\varepsilon & -\Delta\psi\sin\varepsilon \\ +\Delta\psi\cos\varepsilon & 1 & -\Delta\varepsilon \\ +\Delta\psi\sin\varepsilon & +\Delta\varepsilon & 1 \end{bmatrix}$$

Daily values of $\Delta\psi$ and $\Delta\varepsilon$ during 2019 are tabulated on pages 18 to 32.

Approximate reduction for precession and nutation in right ascension and declination from the standard equinox and equator of J 2000.0 to the true equinox and equator of date during 2019 can be done using the following formulae and table :

$$\alpha = \alpha_o + f + g \sin(G + \alpha_o)\tan\delta_o$$
$$\delta = \delta_o + g\cos(G + \alpha_o)$$

where the units of the correction to α_o and δ_o are in second of time and minutes of arc respectively.

Date 2019	f s	g s	g ′	G h m	Date 2019	f s	g s	g ′	G h m
Jan. - 3 *	+57.5	25.0	6.24	00 03	**July 6**	+59.0	25.7	6.41	00 02
7	+57.6	25.0	6.26	00 03	**16** *	+59.1	25.7	6.42	00 02
17	+57.7	25.1	6.26	00 03	**26**	+59.2	25.7	6.43	00 02
27	+57.8	25.1	6.28	00 03	**Aug. 5**	+59.3	25.8	6.44	00 02
Feb. 6 *	+57.9	25.1	6.29	00 03	**15**	+59.4	25.8	6.45	00 02
16	+57.9	25.2	6.29	00 03	**25** *	+59.4	25.8	6.46	00 02
26	+58.0	25.2	6.30	00 03	**Sept. 4**	+59.5	25.9	6.47	00 02
Mar. 8	+58.0	25.2	6.31	00 02	**14**	+59.6	25.9	6.47	00 01
18 *	+58.1	25.3	6.31	00 02	**24**	+59.6	25.9	6.48	00 01
28	+58.2	25.3	6.32	00 02	**Oct. 4** *	+59.7	25.9	6.48	00 01
Apr. 7	+58.2	25.3	6.32	00 02	**14**	+59.7	26.0	6.49	00 01
17	+58.3	25.3	6.33	00 02	**24**	+59.8	26.0	6.50	00 01
27 *	+58.4	25.4	6.34	00 02	**Nov. 3**	+59.9	26.0	6.51	00 02
May 7	+58.4	25.4	6.34	00 02	**13** * †	+59.9	26.0	6.51	00 02
17	+58.5	25.4	6.35	00 02	**23**	+60.0	26.1	6.52	00 02
27	+58.6	25.5	6.37	00 03	**3**	+60.2	26.1	6.54	00 02
June 6 *	+58.7	25.5	6.38	00 03	**Dec. 13**	+60.3	26.2	6.55	00 02
16	+58.8	25.5	6.39	00 03	**23** *	+60.4	26.2	6.56	00 02
26	+58.9	25.6	6.40	00 02	**33**	+60.5	26.3	6.57	00 01
July 6	+59.0	25.7	6.41	00 02					

* 40 - day date   † 400 day date for osculation epoch

Differential Precession and Nutation can be applied to obtain the differences in the mean place of an object relative to a comparison star for a standard epoch (J 2000.0) using the following formulae:

correction to R.A. : $e \tan \delta \Delta\alpha - f \sec^2 \delta \Delta\delta$

correction to declination : $f \Delta\alpha$

where $\Delta\alpha$ and $\Delta\delta$ are the observed differences in right ascension and declination of the object relative to the comparison star and

$e = -\cos\alpha\,(n\,t + \sin\varepsilon\,\Delta\psi) - \sin\alpha\,\Delta\varepsilon$

$f = +\sin\alpha\,(n\,t + \sin\varepsilon\,\Delta\psi) - \cos\alpha\,\Delta\varepsilon$

$\varepsilon = 23^\circ.44,\ \sin\varepsilon = 0.398$

$n = 0.000\,0972$ radian for epoch J 2019.5

t is the time in years from the standard epoch to the time of observation.

$\Delta\psi$, $\Delta\varepsilon$ are nutations in longitude and obliquity at the time of observation expressed in radians, (1" = 0.000 004 8481 rad).

Aberration

Aberration is the displacement of the position of a celestial object due to finite speed of light. The actual velocity of light in space c is the vectorial sum of its velocity relative to the observer c_r and the velocity V of the observer. Although the special theory of relativity has no provision of breaking up aberration of light into components, total effects of aberration in astronomy are broken into stellar, annual, elliptic, secular and planetary aberration for convenience of computation. In case of stars, all that can be determined is the displacement in their positions caused by the motion of the observer alone. It is calculated on the basis of the actual instantaneous motion of the Earth round the barycentre of the solar system.

Earlier, the practice was to resolve the stellar aberration into two components; one contributed by the circular motion of the Earth moving with a constant mean velocity round the Sun, and the other, a nearly constant displacement perpendicular to the major axis of the orbit arising due to ellipticity of the orbit of the Earth. The latter, known as the E-terms of aberration was included in the mean position of the stars as given in star catalogues and was omitted in the computation of day numbers. As a result, the mean places of stars differed from the catalogue mean places. This procedure was adopted to minimise the computation work for the user of star catalogues. However, this practice has caused much confusion lately because the accurate total velocity of the Earth referred to the barycentre of the solar system could not be used in computing stellar aberration. In accordance with a decision of the IAU in 1976, this occasion has been used to simplify this procedure by removing the E terms of aberration from the mean places and to include them in the reduction from mean to apparent place so that the apparent places remain unchanged. Thus, the mean places of FK5 are free from E terms. In other words, they will be the positions of the stars at epoch J 2000.0 as viewed from the barycentre of the solar system, in the co-ordinate system defined by the Earth's mean equator and equinox of J 2000.0.

The conversion of 1950.0 star catalogue positions (α,δ) to actual mean places ($\alpha+\Delta\alpha$, $\delta+\Delta\delta$) can be accomplished by :

$$\Delta\alpha = 0^s.0227 \sin(\alpha + 11^h.25) \sec\delta$$

$$\Delta\delta = 0''.341 \cos(\alpha + 11^h.25) \sin\delta + 0''.029 \cos\delta$$

For solar system objects, the displacement of the light source during the time (Δt) taken by light to travel from it to the Earth combined with the effect of relative motion of the Earth and the light is known as planetary aberration. Its computation requires a knowledge of the distance and motion of the light source and can be accomplished as follows. First, the barycentric position of the body at time $t-\Delta t$ is combined with the barycentric position of the Earth at time t and then the correction for annual aberration is applied. Planetary aberration may also be

computed by interpolating the geometric (geocentric) ephemeris of the body to the time $t - \Delta t$. The light time Δt is given by:

$$\Delta t \text{ (in days)} = 0.005\,7755 \times \text{distance in a.u.}$$

Annual aberration for reduction from a geometric place (α_0, δ_0) to an apparent geocentric place (α, δ) is given by :

$$\alpha = \alpha_0 + (-\dot{X} \sin \alpha_0 + \dot{Y} \cos \alpha_0) / (c \cos \delta_0)$$

$\delta = \delta_0 + (-\dot{X} \cos \alpha_0 \sin \delta_0 - \dot{Y} \sin \alpha_0 \sin \delta_0 + \dot{Z} \cos \delta_0)/ c$, where c = 173.14 a.u./day and $\dot{X}$, $\dot{Y}$, $\dot{Z}$ are the velocity components of the Earth (pages 256 to 270).

The reduction of observations of the radial velocity to a common origin at the barycentre is given by adding the component of the Earth's velocity in the direction (α_0, δ_0) of the object :

$$\dot{X} \cos \alpha_0 \cos \delta_0 + \dot{Y} \sin \alpha_0 \cos \delta_0 + \dot{Z} \sin \delta_0$$

Differential annual aberration corrections to be added to the observed differences of right ascension and declination (in the sense moving object minus star) to give true differences are:

(R.A.) a $\Delta\alpha + b\,\Delta\delta$ (in units of $0^s.001$) ; (declination) c $\Delta\alpha + d\,\Delta\delta$ (in units of 0".01)

Here $\Delta\alpha$ is to be taken in units of 1^m and $\Delta\delta$ in units of 1'. The coefficients a, b, c and d are defined by:

$a = -5.701 \cos (H+\alpha) \sec \delta$
$b = -0.380 \sin (H+\alpha) \sec \delta \tan \delta$
$c = +8.552 \sin (H+\alpha) \sin \delta$
$d = -0.570 \cos (H+\alpha) \cos \delta$
$H^h = 23.4 - (\text{day of year}/15.2)$

(The day of year is tabulated on pages 4 to 12)

Annual parallax correction can be calculated approximately for reduction from the catalogue place (α_0,δ_0) to the geocentric place (α,δ) using the following formulae;

$\alpha = \alpha_0 + (\pi / 15 \cos \delta_0)(X \sin \alpha_0 - Y \cos \alpha_0)$ and $\delta = \delta_0 + \pi(X \cos \alpha_0 \sin \delta_0 + Y \sin \alpha_0 \sin \delta_0 - Z \cos \delta_0)$

where π is the annual parallax and X, Y, Z, are the coordinates of the Earth as given on pages 256 to 270.

Deflection of light in the gravitational field of the Sun may significantly affect the apparent direction of a star or of a body in the solar system. The elongation (E) from the centre of the Sun is increased by an amount that, for a star, depends on the elongation in the following manner:

$$\Delta E = 0''.004\,07 / \tan (E/2)$$

E	0°.25	0°.5	1°	2°	5°	10°	20°	50°	90°
ΔE	1".866	0".933	0".466	0".233	0".093	0".047	0".023	0".009	0".004

The body disappears behind the Sun when E is less than the limmiting grazing value of about 8°.25. The effects in right ascension and declination may be calculated approximately from;

$\cos E = \sin \delta \sin \delta_0 + \cos \delta \cos \delta_0 \cos (\alpha - \alpha_0)$
$\Delta\alpha = 0^s.000\,271 \cos\delta_0 \sin (\alpha - \alpha_0) / (1 - \cos E) \cos \delta$
$\Delta\delta = 0''.004\,07 [(\sin \delta \cos \delta_0 \cos (\alpha - \alpha_0) - \cos \delta \sin \delta_0] / (1 - \cos E)$

where α, δ refer to the star, and α_0, δ_0 to the Sun.

EXPLANATION

TABULAR DATA

PART-I -TIME SCALES AND EPHEMERIDES

Dates of year beginning in 2019 of various Indian and important foreign chronological eras are listed on page 3 followed by Gregorian calendar for the current year (pages 4 to 12). The calendar contains, besides the usual information, a count of Julian Day (JD) number for each date. The system of Julian day numbers maintains a continuous count of astronomical days, beginning with JD = 0 on 1 January 4713 B.C., Julian proleptic calendar. Julian Day numbers for other years can be found from the table on page 367. Various time scales used in this publication, their inter -relationships (as given on page 2) and the basis for computation of sidereal time as tabulated on pages 13 to 16; have been discussed above under the section on time scales. The concept of equation of time defined as the difference between local apparent solar time and local mean solar time (in the sense apparent minus mean) is no longer used in astronomy and therefore, it is no more tabulated in this publication. It can, however, be obtained to a precision of about 1 second using the following relation :

Equation of time at 12^h U.T. = $12^h -$ tabulated value of TT of Sun's ephemeris transit (pages 19 to 33).

In this publication, the ephemeridies of the Sun and planets were reported earlier based on computation jointly made by USNO and JPL by simultaneous numerical integration designated as DE 200/ LE 200. A more recent JPL ephemeris, DE 405/ LE 405 has now come into widespread use, provide barycentric equatorial rectangular coordinates for the period 1600 to 2201. The reference frame for basic ephemerides is the ICRF; the alignment onto this frame has an estimated accuracy of 1 - 2 arcseconds. The JPL DE 405/ LE 405 ephemerides have been developed in a barycentric reference system using a barycentric coordinate time scale $T_{eph.}$. The present edition use the DE 405/ LE 405 ephemeridies data on the positions of the Sun, Moon and planets. The value of some astronomical constants based on previously used DE200/ LE200 ephemeridies and currently used DE 405/ LE 405 ephemerides are given below.

Constant	DE 405 Value	DE 200/ LE 200 Value
Light-time for unit distance, τ_A	499.004 783 84 s	499.004 7837……….s
Geocentric gravitational constant, GE	3.986 004 418 x $10^{14} m^3 s^{-2}$	3.986 004 48……x $10^{14} m^3 s^{-2}$
Heliocentric gravitational constant, GS	1.327 124 42 099 x $10^{20} m^3 s^{-2}$	1.327 124 40……x $10^{20} m^3 s^{-2}$
Ratio of mass of Sun to that of Earth, (GS)/ (GE)	332 946.0 487	332 946.038……….
Ratio of mass of Moon to that of Earth, μ	0.012 300 0371	0.012 300 034
Obliquity of the ecliptic at J2000.0, ε	23° 26′ 21″.406	23° 26′ 21″.4119….
Unit distance, A	1.495 978 707 x 10^{11} m	1.495 978 7066 x 10^{11} m
Ratio of mass of Sun to that of Earth + Moon	328 900.5596	328 900.55
Ratio of mass of Sun to mass of each planet :		
Jupiter	1047.348 644	1047.350
Saturn	3497.9018	3498.0
Uranus	229 02.98	229 60
Pluto	1.365 66 x 10^8	1.3 x 10^8
Pallas	9.709 x 10^9	9.247 x 10^9
Vesta	7.407 x 10^9	7.253 x 10^9

EXPLANATION

The Sun

Mean elements of the orbit of the Sun can be calculated with the help of the following expressions for use during 2018 only :

Geometric mean longitude	:	L	=	$279^\circ.380\,654 + 0.985\,647\,36\ d$
Mean longitude of perigee	:	Γ	=	$283^\circ.263\,996 + 0.000\,047\,08\ d$
Mean anomaly	:	g	=	$356^\circ.116\,659 + 0.985\,600\,28\ d$
Eccentricity	:	e	=	$0^\circ.016\,700\,64 - 0.\,000\,000\,0012\ d$
Obliquity of the ecliptic w.r.t. mean equator of date	:	ε	=	$23^\circ.436\,808 - 0.000\,000\,36\ d$

where d is the interval in days from 2019 January 0 at 0^h TT and is given by

d = JD $-$ 245 7387.5 = day of the year (pages 4 to 12) $+$ fraction of day from 0^h TT.

The above angular elements are referred to the mean equinox and ecliptic of date. The position of ecliptic of date with respect to the ecliptic of the standard epoch J 2000.0 is given by the formulae given under *Precession.*

The length of the principal years at 2019.0 as derived from the Sun's mean motion are given on page 2.

Geometric longitude of the Sun with respect to the mean equinox of date is tabulated on even numbered pages 18 to 32. Apparent longitude and latitude are with respect to the true equinox and ecliptic of date respectively. The two longitudes are related as follows :

Apparent longitude = Geometric longitude $+$ nutation in longitude $-$ $20''.4955/$ R.

Aberration has been computed by dividing 20".4955 by the true distance to the Sun. Precession in longitude is the total precessional displacement of a point along the ecliptic since the epoch J 2019.5. Revised value of the annual general precession p = $0^\circ.\,013\,9701$ (for J 2019.5) has been used to compute this quantity. Components of nutation are the results of summation of the revised series of nutation. The sum of the terms with period shorter than 35 days is separately tabulated under Besselian Day numbers (pages 244 to 251).

Apparent Right Ascension and true distance (radius vector), declination (tabulated on odd numbered pages 19 to 33) of the Sun have been computed from the original barycentric rectangular co-ordinates. Although the apparent right ascension and declination have been corrected for light time, the radius vector or the true geocentric distance in astronomical units is the geometric distance at the tabular time.

The Semidiameter is based on a value of $16'\,01''.18$ at unit distance being inclusive of an allowance for irradiation of $1''.55$. The tabular value is obtained by dividing $16'\,01''.18$ by the radius vector.

Ephemeris Transit is the TT of the transit of the Sun over the ephemeris meridian which according to its definition, is 1.002 7379 ΔT east of the Greenwich meridian. Here ΔT is the difference TT $-$ UT. This transit time. This transit time can be interpolated to other meridians with an interpolating factor p, as follows:

$$p = -\lambda/360 + 1.002\,7379 \times \Delta T/86400$$

where λ is the longitude (east positive). The interpolated TT can be converted into UT by subtracting ΔT from TT.

Equatorial rectangular co-ordinates (geocentric) of the Sun, referred to the ICRS axes, are given in a.u. on pages 34 to 41. The direction of these axes have been defined by the IAU and realized in practice by the coordinates of several hundred extra galactic radio sources.

EXPLANATION

Horizontal parallax (page 17) of the Sun is the angle subtended at the Sun by the equatorial radius of the Earth. The new value of the Solar parallax $\Pi_{\circ} = 8''.794\,148$ has been used to compute the horizontal parallax.

Mean longitude and mean anomaly (page 17) of the Sun have been computed using revised expressions for the mean motion of the Earth around the Sun as given on page 455.

Heliographic co-ordinates given on pages 42 to 45 for 0^h UT include the position angle P of the northern extremity of the axis of rotation measured eastward from the north point of the disc and the heliographic latitude $B_{\circ}$ and longitude $L_{\circ}$ of the central point of the disc.

The observed angular distance ρ_1 from the centre of the disc of the Sun of a feature on the Sun's surface, as seen from the Earth, can be converted into its heliocentric angular distance ρ from the centreof the Sun's disc as follows :

$$\sin(\rho + \rho_1) = \rho_1 / S, \quad \text{where } S \text{ is the semi diameter of the Sun.}$$

The observed position (ρ, θ) of a feature (Sunspot, etc.) with respect to the centre of Sun's disc can be converted into heliographic co-ordinates (L, B) as follows :

$$\sin B = \sin B_{\circ} \cos \rho + \cos B_{\circ} \sin \rho \cos (P - \theta)$$
$$\cos B \sin (L - L_{\circ}) = \sin \rho \sin (P - \theta)$$
$$\cos B \cos (L - L_{\circ}) = \cos \rho \cos B_{\circ} - \sin B_{\circ} \sin \rho \cos (P - \theta)$$

The physical ephemeris of the Sun has been calculated from the elements determined by R. C. Carrington (observation of the spots on the Sun, 1863).

The Synodic rotation numbers are given below according to R. C. Carrington's Greenwich photoheliographic series which commenced on 9 November, 1853 with number 1. The standard solar meridian from which heliographic longitudes on the surface of the Sun are measured (positive towards the west) is that which passes through the ascending node of the solar equator on the ecliptic on 1854 January 1, Greenwich mean noon. The beginning of each synodic rotation is the instant at which the standard solar meridian passes through the central point of the apparent disc of the Sun, i.e., when the heliographic longitude $L_{\circ}$ of this central point is zero.

SYNODIC ROTATION NUMBERS, 2019

Number		Date of Commencement		Number		Date of Commencement		Number		Date of Commencement	
2212	2018	Dec.	20.49	2217		May	6.05	2222		Sept.	19.16
2213	2019	Jan.	16.83	2218		June	2.27	2223		Oct.	16.44
2214		Feb.	13.17	2219		June	29.47	2224		Nov.	12.74
2215		Mar.	12.50	2220	2019	July	26.67	2225	2019	Dec.	10.05
2216		Apr.	08.80	2221		Aug.	22.90	2226	2020	Jan.	6.38
								2227		Feb.	2.72

At the date of commencement of each synodic rotation period, the value of $L_{\circ}$ is zero ; that is, the prime meridian passes through the central point of the disk.

The mean rotational elements of the Sun during 2019 are as follows :

Longitude of the ascending node of the solar equator on the ecliptic of date is 76°.03, and on the mean equator of date 16°.16. Inclination of the solar equator on the ecliptic of date is 7°.25, and on the mean equator of date 26°.10. The mean position of the pole on the solar equator is at right ascension 286°.16 and declination 63°.90. Sidereal period of rotation of the prime meridian is 14°.18 44 per day and its mean synodic period of rotation is 27.2753 days.

EXPLANATION

The Moon

The ephemerides of the Moon reported in this publication are based on the fundamental arguments developed by Simon et. al (1994). The angular elements are referred to the mean equinox and ecliptic of date. Mean elements of the mean equator and of the orbit of the Moon (page 47) can be computed during 2019 with the help of the following expressions :-

The inclination i of the mean equator of the Moon to the true equator of the Earth is given by :

$$i = 24^\circ.1877 - 0.001\,237\,d - 0.000\,000\,235\,d^2$$

The arc of the mean equator of the Moon from its ascending node on the true equator of the Earth to its ascending node on the ecliptic of date :

$$\Delta = 300^\circ.6740 - 0.051\,300\,d - 0.000\,001\,309\,d^2$$

The arc of the true equator of the Earth from the true equinox of date to the ascending node of the mean equator of the Moon :

$$\Omega' = -\,3^\circ.33691 - 0.001\,795\,d + 0.000\,001\,443\,d^2$$

The inclination (I) of the mean equator of the Moon to the ecliptic $= 1^\circ\,32'\,33''.6$.

The ascending node of the mean lunar equator on the ecliptic is at the descending node of the mean lunar orbit on the ecliptic that is at longitude $\Omega + 180^\circ$.

The above expressions give the mean elements with respect to the true equator of the Earth to a precision of about $0^\circ.001$.

The following expressions for the mean elements of the orbit of the Moon Γ', Ω mean longitude of the Moon L' and elongation D are referred to the mean equinox and ecliptic of date.

Mean longitude of the Moon, measured along the ecliptic to the mean ascending node and then along the mean orbit :

$$L' = 202^\circ.743524 + 13.176\,396\,46\,d$$

Mean longitude of the Moon's perigee measured in the same way as L' :

$$\Gamma' = 136^\circ.326207 + 0.111\,403\,41\,d$$

Mean longitude of the mean ascending node of the lunar orbit on the ecliptic :

$$\Omega = 117^\circ.624\,932 - 0.052\,953\,74\,d$$

Mean elongation of the Moon from the Sun :

$$D = L' - L = 283^\circ.362\,870 + 12.190\,749\,10\,d$$

Mean inclination of the lunar orbit to the ecliptic $= 5^\circ.156\,689\,8$

The above expressions are valid for use in 2019 only.

In all the above expressions, the time argument d is the interval in days since 0^h TT January 0, 2019 and is given by $d = \mathrm{JD} - 245\,8483.5$

The length of the principal mean months at 2019.0 as derived from the above mean orbital elements of the Moon are given on page 2.

The apparent geocentric longitude and latitude of the Moon (pages 48 to 63) are referred to the true equinox and ecliptic of date. The true distance between the centres of the Earth and the Moon is given in a.u. Semi-diameter is derived from the horizontal parallax by $S = \mathrm{Sin}^{-1}(k \sin\pi)$ where $k = 0.272\,5076$. The semi-diameter at mean distance is taken to be $15'\,32''.58$ without making any correction for irradiation.

EXPLANATION

The right ascension and declination given on pages 64 to 79 for 0 hour & 12 hour of TT are referred to the true equator and equinox of date.

Horizontal parallax is tabulated at twelve hourly intervals on pages 64 to 79. It is derived from $\sin^{-1}(1/r)$ where r is the true distance in units of the Earth's equatorial radius. The tabulated R.A. and declination have been corrected for light time while the horizontal parallax is the geometric value for the tabular time.

The times of New Moon, First Quarter, Full Moon and Last Quarter are the moments at which the excess of the Moon's apparent longitude over that of the Sun is 0°, 90°, 180° and 270° respectively. Moon at Apogee and Perigee are the times when the Moon is at the greatest and least distance from the Earth. The timings are given in U.T. The corresponding timings in U.T. of the phases of the Moon are also given in the calendar portion on pages 4 to 12. For more precise values of the moments of New Moon and Full Moon, a reference may be made to Part VI - Indian Calendar where the times are given in I.S.T.

Moon's Age, given for 0^h TT, is the number of days elapsed since the preceding New Moon (conjunction). The times of Moon's upper and lower transit are given in TT for the ephemeris meridian. Interpolation to any other meridian by means of differences given and with the help of the ephemeris longitude will yield the local mean time of transit. The apparent geocentric declination given for the time of ephemeris transit can also be similarly interpolated.

Physical ephemeris of the Moon (pages 88 to 95) has been computed using the formulae and constants of D. Eckhardt (*The Moon and the Planets, 25 3, 1981; High precision Earth Rotation and Earth-Moon Dynamics, ed. O. Calame, pages 193-198, 1982)* with inclination I as given above (IAU value).

In case of the Moon, selenographic longitudes are measured for a point on the surface of the Moon from the lunar meridian that passes through the mean central point of the visible disc positive towards the west towards Mare Crisium. Selenographic latitudes are reckoned positive towards the north limb. The mean central point of the disc is defined as the point on the lunar surface intersected by the radius of the Moon directed towards the Earth, when the Moon is simultaneously at the ascending node and coincident with the mean longitude.

The Moon presents roughly the same hemisphere to the Earth. However, due to non uniformity of the revolution of the Moon around the Earth (optical libration) and an oscillation of the actual rotational motion of the Moon about its mean rotation (physical libration), about 59% of the Moon's surface can be seen from the Earth. The contribution to the Earth's selenographic longitude and latitude due to physical libration has been tabulated separately. These are geocentric values.

The tabular selenographic longitude and latitude of the Earth are the selenographic co-ordinates of the apparent central point of the Moon from which point the Earth is in selenographic zenith. These co-ordinates are the total librations (sums of optical and physical librations) in longitude and latitude respectively. When the libration in longitude, i.e. the selenographic longitude of the Earth, is positive, the mean central point of the disc is displaced eastward exposing to view a region on the west limb. When the libration in latitude, i.e. the selenographic latitude of the Earth, is positive, a region on the north limb is exposed to view.

The selenographic co-ordinates of the point on the lunar surface where the Sun is in the Zenith are the selenographic co-ordinates of the Sun. The selenographic co-longitude of the Sun tabulated in the ephemeris is obtained by subtracting the selenographic longitude of the Sun from 90° or 450°; it is approximately 270°, 0°, 90° and 180° at new-moon, first quarter, full-moon and last quarter respectively.

The position angle of the axis is the angle that the lunar meridian through the apparent central point of the disc towards the north lunar pole forms with the declination circle through the central point, reckoned counter clockwise from the north point of the disc.

The position angle of the bright limb is the position angle of the mid point of the illuminated limb, reckoned eastward from the north point of the disc. The position angle of the two cusps may be obtained by adding $\pm 90°$ to that of the bright limb.

The expression for calculating the selenographic altitude (a) of the Sun (above the lunar horizon) at a point at selenographic longitude *l* and latitude *b* is as follows :

$\sin a = \sin b_\circ \sin b + \cos b_\circ \cos b \sin(c_\circ + l)$, where $(c_\circ, b_\circ)$ are the Sun's co-longitude and latitude at the time.

The following expressions can be used to compute the differential corrections to be applied to the tabular geocentric librations to form the topocentric librations :

$$\Delta l = -\pi' \sin(Q - C) \sec b$$
$$\Delta b = +\pi' \cos(Q - C)$$
$$\Delta C = +\sin(b + \Delta b)\,\Delta l - \pi' \sin Q \tan\delta,$$

where Q is the geocentric parallactic angle of the Moon and π' is the topocentric horizontal parallax. The latter is obtained from the geocentric horizontal parallax (π) (pages 64 to 79) by using :

$$\pi' = \pi\,(\sin z + 0.0084 \sin 2z)$$

where z is the geocentric zenith distance of the Moon. The values of z and Q may be calculated from the geocentric R.A. (α) and declination (δ) of the Moon by using :

$$\sin z \sin Q = \cos\phi \sin h$$
$$\sin z \cos Q = \cos\delta \sin\phi - \sin\delta \cos\phi \cos h$$
$$\cos z = \sin\delta \sin\phi + \cos\delta \cos\phi \cos h$$

where ϕ is the geocentric latitude of the observer and h is the local hour angle of the Moon given by :

h = local apparent sidereal time $-\,\alpha$

Second differences in the tabular values of the geocentric librations must be taken into account in interpolation for the time of observation.

Major Planets

The heliocentric and geocentric positions of the major planets given on pages 96 to 197 have been derived directly from the numerical integration mentioned on page 454.

The heliocentric longitude and latitude are referred to the mean equinox and ecliptic of date. The tabular argument of heliocentric ephemeris is barycentric dynamical time (TDB).

The apparent geocentric longitude and latitude are referred to the true equinox and ecliptic of date and are planetary aberration. The apparent right ascension and declination are also corrected for planetary aberration and referred to the true equinox and equator of date. The tabular argument for both the terrestrial dynamical time (TDT). The TDT of transit over the ephemeris meridian has been furnished, which may be interpolated to any other meridian to obtain the LMT of transit.

As regards Pluto, in addition to the usual data, figures have been furnished for reduction of the apparent right ascension and apparent declination to the corresponding astrometric places referred to the mean equinox and equator of J 2000.0. The astrometric ephemeris is obtained by first adding the usual planetary aberration to the

planet's true geocentric places referred to the standard equinox J 2000.0 and then subtracting the stellar aberration pertinent to the position occupied by the planet. The astrometric place is thus affected by the amount of the terms in the aberration dependent on the longitude of the Earth's perihelion as are the catalogue mean places of stars in the neighbourhood. The astrometric ephemeris is, therefore, rigorously comparable with photographic observations that are referred to catalogue mean places J 2000.0 of neighbouring stars, it being only necessary to correct the observations for geocentric parallax in case of the planets and proper motion in case of the stars.

The tabular true distance from the Earth is the actual geocentric distance at the tabulated time and not at the instant when the light left the planet.

The horizontal parallax of planets is $8''.794\ 143$ divided by the geocentric distance. As regards the semi-diameter, the tabulated value is the value at unit distance divided by the geocentric distance. The semi-diameters at unit distance are as follows : Mercury $3''.36$, Venus $8''.34$, Mars $4''.68$, Jupiter $98''.57$ (Equatorial) and $92''.12$ (Polar), Saturn $83''.13$ (Equatorial) and $74''.96$ (Polar), Uranus $35''.24$, Neptune $34''.14$ and Pluto $2''.07$.

The heliocentric osculating elements of the orbits of the major planets, including Pluto, are given at intervals of 40 days on pages 200 to 201. The osculating elements are the elements of the instantaneous ecliptic orbit of the planet around the Sun determined by its actual position and velocity components for the instant, and as such the elements are affected by the attractions of other planets. The true place of a planet deduced from these elements is thus inclusive of the planetary perturbations, which need not, therefore, be considered separately in such a deduction.

The osculating elements for the Earth refer to the Earth/Moon barycentre. The correction in ecliptic rectangular co-ordinates in conversion from the Earth/Moon barycentre to the Earth's centre is given by :

$$\text{Earth's Centre} = (\text{Earth / Moon barycentre}) - (0.000\,0312 \cos L,\ 0.000\,2865 \sin L,\ 0.0000124 \sin L,$$
$$-0.00000718 \sin L, 0.00000657 \cos L,\ 0.00000285 \cos L)$$

where $L = 218^\circ + 481\,268^\circ\, T$, with T measured in Julian centuries from JD 245 1545.0 to 5 decimals; the co-ordinates are in a.u. with reference to mean equinox and ecliptic of date.

PART II - STARS

The mean places of 482 stars, apparent places of 68 stars at 10-day intervals. daily apparent place of *Polaris* and tables for finding latitude of place from altitude of polaris and azimuth of polaris are given in this section. The ecliptic co-ordinates (mean longitude and latitude) of 451 stars have also been given. To facilitate reduction from mean to apparent place of a star, Besselian Day Numbers as well as the barycentric position and velocity components of the Earth alongwith rotation matrix elements for precession and nutation have been tabulated.

Mean Places of Stars (pages 215 to 226)

Beginning with the issue for 1988, calculation of the mean and apparent places are based directly on the basic-FK5 compiled by the A.R.I., Heidelberg.

The table for mean places of stars includes all stars of magnitude upto 3.9 as well as the component stars of the different lunar asterisms of the Hindus, Chinese and Arabian even when those are fainter than magnitude 3.9.

In case double or multiple stars, *m* denotes the mean position of the centre of gravity (*c.g.*) of the system; *p* the preceding component having less right ascension, *f* the following component and *A* the brighter component of the system. The magnitude of the binary stars is the integrated value for the two components.

EXPLANATION

The mean longitude and latitude of 451 important stars have been computed using the conversion from equatorial mean positions to ecliptic co-ordinates. Similarly, annual variations in longitude and latitude, etc., are the differentials of the conversion formulae. All quantities relate to the middle of the current Julian year.

Apparent Places of Stars (pages 227 to 243)

The apparent places of 68 selected stars are reported under this section. These positions are completely based on the FK5 beginning with the issue for 1988.

Smaller aberration has been computed from the total velocity of the Earth referred to the barycentre of the solar system. The E-terms of aberration are no longer included in the mean places in the FK5, but rather in the reduction from mean to apparent places.

Reductions to apparent places have been computed rigorously and directly without the intermediary of the mean place for the begining of the year. The rigorous computation also includes effects of relativistic light deflection. Because of this, the apparent places of a star when approaching very closely the Sun cannot be interpolated by the user, but these cases are of no practical interest in normal applications.

Apparent places of 68 bright stars with annual variation and annual proper motion at 10-day interval have been given on pages 227 to 243. The number, name, are taken generally from the FK5, magnitude and spectrum are taken from SIMBAD data base. Corrections for parallax have been applied where appreciable.

The right ascension and declination are referred to the true equator and equinox of date but with the omission of the short period terms of nutation. After interpolating the given apparent places to date and longitude of the station, the following corrections for the effect of short period terms of nutation are to be applied :

$$\Delta\alpha = a\, d\psi + b\, d\varepsilon \quad \text{seconds of time}$$
$$\Delta\delta = a'\, d\psi + b'\, d\varepsilon \quad \text{seconds of arc}$$

where $d\psi$ and $d\varepsilon$ are short period terms of nutation as tabulated on pages 244 to 251. The values of a, b, a' and b' are given for each star under the apparent place.

The Apparent places of Polaris for each day of the year (pages 272 to 274) have been computed rigorously.

Besselian Day Numbers (pages 244 to 251)

All stellar data tabulations are now for the standard epoch at the middle of the current Julian year rather than the beginning of the Besselian year and accordingly the Besselian Day Numbers and second order day numbers are referred to the mean equator and equinox of the epoch, J 2019.5. Although for full precision the reduction to the apparent place has to be computed rigorously as described below, Besselian Day Numbers can still be used for less precision.

In the tabulated data, τ is the fraction of the Julian year since the standard epoch J 2019.5 A, B and E are Besselian Day Numbers designed to incorporate corrections to the position of a star on account of precession and nutation. In this case, the correction due to precession is measured from the middle of the year, and this is secured by incorporating in A the value of the precision corresponding to τ.The terms of short-period in nutation are included in A and B, which are also shown separately on pages 244 to 251.

The Besselian Day Numbers C and D, designed to include the effect of aberration, are now computed based on the total velocity of the Earth.

Second order day numbers, needed only for high declination stars for high accuracy, have been tabulated on pages 252 to 255.

EXPLANATION

The barycentric position and velocity components of the Earth and rotation matrix elements for rigorous reduction of precesision and nutation have been tabulated on pages 256 to 270. Use of these data with examples is discussed below :-

Apparent place reduction with full precision (rigorous method)

Conversion of the barycentric co-ordinates of a star for the standard equinox and equator of J 2000.0 (TDB) to its apparent geocentric co-ordinates referred to the true equinox and equator of date (TT) can be done rigorously as follows:

The geocentric vector **P** of the star at the required epoch (ignoring the distinction between TDB and TT for the stellar case) is given be by:

$$\mathbf{P} = \mathbf{q} + T\mathbf{m} - \pi \mathbf{E_B} \quad \ldots\ldots\ldots(1)$$

Here **q** is the barycentric direction of the star at epoch J 2000.0 referred to the standard equinox and equator of J2000.0 and is given by :-

$$\mathbf{q} = (\cos\alpha_0 \cos\delta_0,\ \ \sin\alpha_0 \cos\delta_0,\ \ \sin\delta_0)$$

where α_0 and δ_0 are the right ascension and declination for the equator, equinox and epoch of J 2000.0.

The space motion vector $\mathbf{m} = (m_x, m_y, m_z)$ of the star in equation (1), expressed in radians/century, is given by :

$$\begin{aligned} m_x &= -\mu_\alpha \cos\delta_0 \sin\alpha_0 - \mu_\delta \sin\delta_0 \cos\alpha_0 + \nu\pi \cos\delta_0 \cos\alpha_0 \\ m_y &= \mu_\alpha \cos\delta_0 \cos\alpha_0 - \mu_\delta \sin\delta_0 \sin\alpha_0 + \nu\pi \cos\delta_0 \sin\alpha_0 \\ m_z &= \mu_\delta \cos\delta_0 + \nu\pi \sin\delta_0 \end{aligned}$$

where these expressions take into account the radial velocity (v) in au/century (1 km/s = 21.094 952 75 a.u./ century), measured positively away from the Earth as well as proper motion(μ_α, μ_δ) in right ascension and declination in radian/century and π is the parallax in radians.

T is the interval in Julian centuries from J2000.0, given by T = (JD – 245 1545.0)/ 36525; $\mathbf{E}_B$ and $\dot{\mathbf{E}}_\mathbf{B}$ in a.u. per day are Earth's barycentric position and velocity vectors at co-ordinate time t = TDB referred to the equator and equinox of J 2000.0 (pages 256 to 270).

The heliocentric position of the Earth **E** is given by

$$\mathbf{E} = \mathbf{E}_B - \mathbf{S}_B \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where $\mathbf{S_B}$ is the barycentric position of the Sun at time t. This can be obtained from the heliocentric position of the barycentre tabulated on page 202 by reversing the sign of the respective x, y, and z.

The geocentric direction **p** of the star and the unit vector **e** can be computed from $\mathbf{p} = \mathbf{P}/|\mathbf{P}|$ and $\mathbf{e} = \mathbf{E}/|\mathbf{E}|$

The geocentric direction $\mathbf{p_1}$ of the star after applying the correction for light deflection in the natural frame is obtained as follows:

$$\mathbf{p_1} = \mathbf{p} + (2\ \mu/c^2 E)\,(\mathbf{e} - (\mathbf{p}.\mathbf{e})\,\mathbf{p})/(1 + \mathbf{p}.\mathbf{e}) \ldots\ldots\ldots\ldots..(3)$$

EXPLANATION

Where $\mu/c^2 = 9.87 \times 10^{-9}$ a.u and $E = |\mathbf{E}|$, the vector $\mathbf{p_1}$ is a unit vector to the order of μ/c^2 and dot (**.**) indicates scalar product.

The proper direction $\mathbf{p_2}$ in the geocentric inertial frame, that is moving with the instantaneous velocity **V** of the Earth relative to the natural frame, is given by:

$$\mathbf{p_2} = (\beta^{-1}\mathbf{p_1} + (1 + \mathbf{p_1}.\mathbf{V})/(1+\beta^{-1}))\mathbf{V}) / (1+\mathbf{p_1}.\mathbf{V}) \ldots\ldots\ldots\ldots\ldots(4)$$

Where $\mathbf{V} = \dot{\mathbf{E}}_\mathbf{B}/c = 0.0057755\,\dot{\mathbf{E}}_\mathbf{B}$ and $\beta = (1 - V^2)^{-1/2}$; the velocity **V** expressed in units of velocity of light and is equal to the Earth's velocity in the barycentric frame to the order of V^2.

The apparent geocentric direction $\mathbf{p_3}$ is obtained by applying precession and nutation to the proper direction $\mathbf{p_2}$ by multiplying it row by column with the rotation matrix M=NPB (given on pages 257 to 271) as follows:

$$\mathbf{p_3} = M\,\mathbf{p_2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots..\ (5)$$

The above direction $\mathbf{p_3}$ is in rectangular co- ordinates (ξ, η, ζ). It can be converted into spherical co- ordinates (α, δ) using :

$$\alpha = \tan^{-1}(\eta/\xi) \quad \text{and} \quad \delta = \tan^{-1}(\zeta/\beta) \ldots\ldots\ldots\ldots\ldots\ldots(6)$$

Where $\beta = (\xi^2 + \eta^2)^{1/2}$

where the quadrant of α can be determined by the signs of ξ and η.

Correction for polar motion :

The apparent geocentric direction $\mathbf{p_3}$, given by equation (5) above, is for the true equator and equinox with the z axis pointing towards the celestial ephemeris pole. A further correction for polar motion may be applied to $\mathbf{p_3}$ to obtain $\mathbf{p_4}$ i.e. the direction relative to the conventional terrestrial reference system in which the z-axis is in the direction of the adopted mean position of the pole, as follows :

$$\mathbf{p_4} = \mathbf{R_2}(-x)\,\mathbf{R_1}(-y)\,\mathbf{R_3}(\text{GAST})\,\mathbf{p_3}$$

where GAST is the Greenwich apparent sidereal time at the corresponding instant of UT and

$$\mathbf{R_1}(\theta) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & -\sin\theta & \cos\theta \end{bmatrix} \qquad \mathbf{R_2}(\theta) = \begin{bmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{bmatrix}$$

$$\mathbf{R_3}(\theta) = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

are the standard matrices that produce rotations through an angle θ about the x, y and z - axes respectively.

Polar motion is described by x and y, the co- ordinates of the celestial ephemeris pole with respect to the adopted origin; x and y are measured in seconds of arc from the origin along the meridians at longitudes 0° and 270°. Current values for the reduction of observations are published by the International Polar Motion Service and the Bureau International de l' Heure.

EXPLANATION

Example of stellar reduction :

Calculation of apparent position of a fictitious star on 2019, January 1 at 0^h TT from the catalogue data, mean right ascension (α_0) , declination (δ_0), centennial proper motion (μ_α , μ_δ) in right ascension and declination, parallax (π) and radial velocity (ν) of a fictitious star for the standard equinox and equator of J 2000.0 (TDB) as given below:

$\alpha_0 = 14^h\ 39^m\ 36^s.087$

$\mu_\alpha = -49.486$ s/ century
$= -0.003\,598\,723$ rad/century

$\delta_0 = -60^\circ\ 50'\ 07''.14$

$\mu_\delta = +69''.60$ s/ century
$= +0.000\,337\,430$ rad/ century

$\pi = 0''.752$
$= 3.6458 \times 10^{-6}$ rad

$\nu = -22.2$ km/ s
$\nu\pi = -0.001\,707\,357$ rad/ century

The barycentric position vector of the Sun and the position and velocity vectors of the Earth referred to J2000.0 on 2019 January 1, 0^h TDB (pages 202, 256 to 270) are :

Vector	Julian date	Barycentric Rectangular Components x	y	z
$\mathbf{E}_B$	245 6658.5	$-0.174\,604\,201$	$+0.885\,6728$	$+0.3838\,4982$
$\dot{\mathbf{E}}_\mathbf{B}$	245 6658.5	$-0.017\,209\,537$	$-0.002\,876$	$-0.001\,24731$
$\mathbf{S_B}$	245 6658.5	$+0.000\,986\,878$	$-0.002\,052\,799$	$-0.000\,99144$

In order to calculate the geocentric vector **P** of the star at J 2000.0, using equation (1), the vectors **q** and **m** may be computed using positional data of the star.

$\mathbf{q} = (-0.373\,854\,098,\quad -0.312\,594\,565,\quad -0.873\,222\,624)$
$\mathbf{m} = (-0.000\,712\,684,\quad +0.001\,690\,102,\quad +0.001\,655\,340)$
$\mathbf{T} = (245\,66658.5 - 245\,1545.0)/\,36525 \;=\; +0.14$

The geocentric vector **P** may be computed from equation (1) by substituting the vectors **q, m** and $\mathbf{E_B}$ and time **T**.

$\mathbf{P} = (-0.373\,953\,237,\quad -0.312\,357\,950,\quad -0.872\,299\,088)$ and $|\mathbf{P}| = 0.999\,690\,630$

The heliocentric position vector **E** of earth may be obtained using equation (2)

$\mathbf{E} = (-0.175\,591\,079,\quad +0.887\,725\,599,\quad +0.384\,841\,267)$ and $|\mathbf{E}| = 0.983\,357\,395$

The unit vectors **p** and **e** in the direction of **P** and **E** respectively are as follows :

$\mathbf{p} = (-0.374\,042\,722,\quad -0.312\,432\,696,\quad -0.873\,199\,780)$

$\mathbf{e} = (-0.178\,562\,83,\quad +0.902\,749\,705,\quad +0.391\,354\,424)$

The scalar product $\mathbf{p.e} = -0.557\,332\,554$ and $2\mu/c^2 = 1.974 \times 10^{-8}$ a. u. The second term in the equation (3) represents the correction for the light deflection in the natural frame, and is given by the following vector :

$(2\mu/c^2\mathbf{E})\,(\mathbf{e} - (\mathbf{p.e})\,\mathbf{p})/\,(1+\mathbf{p.e}) = (-0.000\,000\,017,\quad +0.000\,000\,032,\quad -0.000\,000\,004)$

Addition of the above correction to the unit vector **p** gives geocentric direction $\mathbf{p_1}$ of the star :

$\mathbf{p_1}$ = ($-$0.373 924 942, $-$0.312 598 105, $-$0.873 191 023)

The velocity vector **V =** 0.005 7755 $\dot{\mathbf{E}}_{\mathbf{B}}$ and $\beta^{-1} = (1 - V^2)^{1/2}$ are as follows:

V = ($-$0.000 099 380, $-$0.000 016 560, $-$0.000 007 180)

β^{-1} = 0.999 999 995

The scalar product $\mathbf{p_1 . V}$ **=** + 0.000 048 374

Now substituting quantities computed above in the equation (4), the proper direction is obtained as:

$\mathbf{p_2}$ = ($-$0.374 006396, $-$0.312 599 120, $-$0.873 155 774)

The precession and nutation matrix (**M**) from page 257 is as follows:

$$\mathbf{M} = \begin{bmatrix} +0.999\,989\,607 & -0.004181501 & -0.001\,816829 \\ +0.004181543 & +0.999\,991257 & +1.91058\text{E-}05 \\ +0.001816733 & -2.67027\text{E-}05 & +0.999\,998349 \end{bmatrix}$$

Finally the apparent geocentric direction $\mathbf{p_3}$ is obtained by multiplying the proper direction $\mathbf{p_2}$ to the precession and nutation matrix as given by the equation (5).

Thus $\mathbf{p_3}$ = ($-$0.371 109001, $-$0.314 176994, $-$0.873 825455) and the apparent right ascension and declination:

$\alpha = \tan^{-1}(\eta/\xi) = 14^{h}\ 41^{m}\ 60^{s}.906$; $\delta = \tan^{-1}(\zeta/\beta) = -60^{\circ}\ 54''\ 60'.90627$

EXPLANATION

PART III - Tables of Sunrise, Sunset, Twilight and Moonrise, Moonset

The times of Sunrise, Sunset and Twilight, which can be obtained immediately from the given tables by simple interpolation for the desired latitude within the scope of the tables, are in local mean time of the place. Strictly speaking, the timings of these events are for places on the meridian of Greenwich. By simple interpolation for longitude, the correct time (L.M.T.) for the station can be obtained, which can thereafter be reduced to the zonal standard time by applying correction of time pertinent to the place.

At the given times of Sunrise and Sunset, the upper limb of the Sun is on the horizon; the true zenith distance of the Sun's center is then taken as 90° 50′, allowing 16′ for semi- diameter and 34′ for horizontal refraction.

The timings of the beginning of morning twilight and ending of evening twilight relate to the instants when the center of the Sun is 18° below the horizon. This is now known as astronomical twilight. The period of twilight has been divided into three parts − Civil when the Sun is 6° below the horizon, Nautical when 12° and Astronomical when 18° and their duration have been given.

The timings of rising and setting in U.T. of a body with right ascension α, declination δ and zenith distance z at latitude ϕ and east longitude λ may be computed from

$$\text{UT} = 0.99727\,[\alpha - \lambda \pm \cos^{-1}\{(\cos z - \sin\phi\sin\delta)/(\cos\phi\cos\delta)\} - \text{GAST at } 0^{h}\,\text{UT}],$$

where each term is expressed in time measure and GAST at 0^h UT as tabulated on page 13. The negative sign in the expression corresponds to rising and positive sign to setting. If the quantity $\{(\cos z - \sin\phi \sin\delta)/(\cos\phi \cos\delta)$ is numerically greater than one, there is no phenomenon. However, the tabulated timings of Moonrise and Moonset have been computed by inverse by interpolation for the zenith distance at z = 90° 34′.001- 0.72755 π, where π is the horizontal parallax of the Moon at the time of phenomena. The above value includes semi-diameter and the effect of refraction.

The Sunrise and Sunset times for certain stations in India (Kolkata, Varanasi, Chennai, Delhi, Mumbai) have been separately computed and given in Indian Standard Time. In these calculations the amount of horizontal refraction has been taken as 31′, the value derived from consideration of the atmospheric conditions in India, and consequently the zenith distance of the Sun's center is 90° 47′ at the times given. In the section on Indian Calendar, the Sunrise and Sunset times which have been given for latitude 23° 11′ North and Central Meridian of India, also relates to the times when upper limb of the Sun is on the horizon as in the general tables.

The Moonrise and Moonset times given for certain latitudes relate to the local mean time calculated for the Central Meridian of India. By simple interpolation with the help of a table given on page 313, the local mean time for any other latitude can easily be obtained. At the time given, the Moon's upper limb is on the horizon and so the true geocentric zenith distance of the Moon's center is 90° 34′ *plus* semi- diameter of the Moon *minus* the horizontal parallax, where 34′ has been allowed for horizontal refraction. Taking the mean values of the semi- diameter and the parallax, the zenith distance of the Moon at the moment is about 89° 52′, which varies from 89° 55′ to 89° 49′ as the parallax increases from 53′.6 to 61′.9.

The times of Moonrise and Moonset for certain stations in India (Kolkata, Chennai, Delhi and Mumbai) are separately calculated and given in I.S.T.

The times of Sunrise, Sunset and Moonrise, Moonset given are for an observer on the surface of the Earth considered to be a flat surface around that point without any obstruction in the directions of rising or setting. For an observer stationed at some elevation above the surface, the rising will be further accelerated and the setting retarded according to the height of the observer. The additional arc of depression to be considered on this account is $2'.10\sqrt{h}$ where h is the height of the observer in meters above the ground level. The dip of the sensible horizon is however $1'.77\sqrt{h}$. The effect of atmospheric refraction is included in the above results, without which both the terms would have got reduced to the same value of $1'.93\sqrt{h}$.

EXPLANATION

The values of the arc of depression according to height of the observer are given below:

Height	Depression	Height	Depression	Height	Depression	Height	Depression
Meters	′	Meters	′	Meters	′	Meters	′
0	0.0	40	13.3	300	36	2000	94
2	3.0	50	14.8	400	42	3000	115
5	4.7	75	18.2	500	47	4000	133
10	6.6	100	21.0	750	58	5000	148
20	9.4	150	25.7	1000	66	6000	163
30	11.5	200	29.7	1500	81	7000	176
40	13.3	300	36.4	2000	94	8000	188

The correction to the rising and setting times due to the above height of the observer may be obtained by multiplying the arc of depression given in the table by the figures from the table below:

Latitude of Station

Decli. of Sun	0°	10°	20°	30°	35°	40°	45°	50°	52°	54°	56°	58°	60°
° ′	m	m	m	m	m	m	m	m	m	m	m	m	m
0	.067	.068	.071	.077	.082	.087	.094	.104	.108	.113	.119	.126	.133
5	.067	.068	.071	.077	.082	.088	.095	.105	.109	.115	.121	.127	.135
10	.068	.069	.072	.079	.083	.089	.097	.108	.113	.119	.126	.133	.142
15	.069	.070	.074	.081	.086	.093	.101	.113	.119	.127	.134	.144	.156
20	.071	.072	.076	.084	.090	.097	.108	.123	.130	.139	.151	.165	.183
23 27	.073	.074	.078	.087	.093	.102	.114	.132	.142	.155	.171	.192	.223

The deviation of the rising or the setting point on the horizon (i.e., amplitude) on account of the above arc of depression h (obtained after adding to it the normal depression at rising or setting) may be found as h tan ϕ sec A, deviation being towards the north in the northern hemisphere and south in the southern hemisphere. Here A, the amplitude of the rising of setting point measured from the east or west point of the horizon, is obtained from sin A – sinδ secϕ. The values of the amplitude for certain latitudes and declinations are given in a table on page 377.

PART IV — ECLIPSES AND OCCULTATIONS

Eclipses and Occultations have been calculated on the basis of the tabulated positions of the Sun and the Moon. The semi-diameters of the Sun and the Moon used in these calculations exclude irradiation. The Sun's tabular semi-diameter which includes irradiation is diminished by 1."55 for this purpose.

The semi-diameter of the Moon given by sin $s = k$ sin π, where π is the Moon's horizontal parallax is based on the adopted constant $k = 0.272\ 5076$ to account for the irregularities of the lunar limb. It corresponds to the mean radius of Watt's datum as determined by observations of occultations and to the adopted radius of the Earth, introduced in 1982 and is consistent with the IAU system of Astronomical constants (1976) . It is used with effect from 1986 in this publication. Refraction is neglected in calculation of eclipses of both the Sun and the Moon.

EXPLANATION

The circumstances of the phenomena are given provisionally in Universal Time, using ΔT (A) = + $69^s.0$ and the points on the Earth's surface are also expressed in terms of geographic longitude measured positively to the east.

Lunar Eclipses

In the calculation of lunar eclipses, the semi-diameter of the shadow -cone has been increased by one-fiftieth to take account of the influence of the atmosphere in absorbing Sun's rays passing through it . In the calculation of rising and setting limits, the time when the centre of the Moon becomes visible on the horizon has been considered as rising or setting. Elsewhere in this book the upper limb visible on the horizon is taken as the criterion for rising or setting. The horizontal refraction used in these calculations of rising and setting is 31′.

The method of computation of a lunar eclipse is detailed below :

Let α, δ be the right ascension and declination of the Moon at an instant T_0 at or very near to the moment of opposition, and let α', δ' be the corresponding co-ordinates of the centre of the Earth's shadow (α'= R. A. of Sun + 12^h, δ' = Sun's declination). Let π, s be parallax and semi-diameter of the Moon and π', s' be parallax and semi-diameter of the Sun.

As the Earth is not a perfect sphere, its shadow will differ slightly from a cone. It would however, be sufficient for our purpose if we use a mean radius for the Earth, which is equivalent to submitting for π a parallax π_1, reduced to latitude 45°, so that $\pi_1 = 0.9983\,33\,\pi$.

The radius of the shadow-cone at Moon's distance is $1.02\,(\pi_1 + \pi' - s')$ for umbra, and $1.02\,(\pi_1 + \pi' + s')$ for penumbra.

Let L be the angle between the centre of the Moon and that of the shadow-cone at the desired circumstance of the eclipse, so that

$L_1 = 1.02\,(\pi_1 + \pi' - s') + s$ . . . . . . for first and last contacts

$L_2 = 1.02\,(\pi_1 + \pi' - s') - s$ . . . . . . for second and third contacts

For the penumbral eclipse,

$L' = 1.02\,(\pi_1 + \pi' + s') + s$ . . . . . . for first and last contacts

The Besselian elements x, y may be computed with sufficient accuracy with the following :

$x = (\alpha - \alpha')\cos\delta$ $\qquad$ x' = hourly variation of $(\alpha - \alpha')\cos\delta$

$y = (\delta - \delta')$ $\qquad$ y' = hourly variation of $(\delta - \delta')$

Let $m\sin M = x$, and $m\cos M = y$, so that $\tan M = x/y$, and $m^2 = x^2 + y^2$. The quantity m, taken always positive at all times, represents the angular distance between the centre of the Moon and of the shadow cone. The angle M may take any value from 0° to 360°.

Again, let $n\sin N = x'$, and $n\cos N = y'$, so that $n^2 = x'^2 + y'^2$, and $\tan N = x'/y'$. The angle N lies in the first or the second quadrant according as y' is positive or negative. The value of n is positive.

The time of greatest obscuration or middle of the eclipse is given by

$$T_0 - 1/n\,\{m\cos(M - N)\} \quad \text{or} \quad T_0 - (x x' + y y')/n^2 \quad \text{(hours)}$$

EXPLANATION

The auxiliary angle ψ is given by :

$\sin \psi = \{ m \sin (M - N) \} / L = (x y' - y x') / nL$. The value of either L_1, L_2 or L' should be used or L according to the circumstances of the eclipse under consideration.

Then, time of the beginning or ending = time of middle + (1/n) ($L \cos \psi$).

The value of ψ should be so taken that $\cos \psi$ may be negative for the beginning and positive for the ending of the phase. In other words, when $\sin \psi$ is positive, i.e., when $(M - N)$ falls in the 1st or the 2nd quadrant, ψ would be in the second quadrant for the beginning and in the first quadrant for the ending; and when $\sin \psi$ is negative, i.e., when $(M - N)$ is in the 3rd or the 4th quadrant, ψ would be in the third quadrant for the beginning and fourth quadrant for the ending.

If greater accuracy is desired, the computations may be repeated using the times obtained above as initial times.

The magnitude of the eclipse, the Moon's diameter being unity, is $(L_1 - \Delta)/ 2s$,

where $\Delta = m \sin (M - N)$ is taken positive. When the computations are repeated for greater accuracy, the average values of L_1, Δ and s for the first and last umbral contacts or those corresponding to the time of greatest obscurations should be used.

When Δ becomes less than L_2, the eclipse is a total one. The computations of the beginning and ending of the total phase may be done in the same way as above using the value of L_2.

The position angle of contact P on the Moon's limb, measured from the north point in the direction N.E.S.W. is $180^\circ + N + \psi$ for the first and last contacts both with umbra and penumbra as the case may be, and is $N + \psi$ for the second and third contacts in case of a total eclipse.

When M is calculated for the exact time of the phenomena, i.e., beginning or ending, then P may be obtained by considering $N + \psi = M$, i.e., $P = M + 180^\circ$ or $P = M$ as the case may be.

Solar Eclipses

Computation of the elements and circumstances of solar eclipses has been done following the method of Bessel. The geometric position of the shadow of the Moon relative to the Earth is described by the Besselian elements in a system of geocentric rectangular co-ordinates. In this system, the geocentric plane perpendicular to the axis of the shadow is taken as the *xy* plane and called the fundamental plane. The *x*-axis is the intersection of the fundamental plane with the plane of equator and is positive towards east. The *y*-axis is positive towards the north. The *z*-axis is parallel to the axis of the shadow and is positive towards the Moon. The tabular values of x and y are the co-ordinates of the axis of the shadow on the fundamental plane in units of the Earth's equatorial radius. The quantities d and μ specify the declination and hour angle of the point on the celestial sphere towards which the axis of the shadow is directed.

The elements l_1 and l_2 are the radii of the penumbral and umbral cones on the fundamental plane. The elements l_2 is regarded as positive for an annular eclipse and negative for a total eclipse. The elements f_1 and f_2 are the angles between the axis of the shadow and the generators of the penumbral and umbral cones respectively.

The Besselian elements x, y, sin d, cos d, μ, l_1 and l_2 are computed and tabulated at an interval of 10 minutes to facilitate the accurate computation of the circumstances of the eclipse. The given eclipse maps show the path of the eclipse, beginning and ending times of the eclipse, the area of visibility and rising and setting limits of the eclipse.

EXPLANATION

The method of computation of the local circumstances of the solar eclipse is given below :

The approximate time (U.T.) of the beginning and ending of a solar eclipse may be obtained from the corresponding eclipse map and used as estimated initial time. To obtain the geocentric rectangular co-ordinates, ξ,, η, ζ of the observer located on the surface of the Earth in geographic longitude λ (measured east positive) and latitude ϕ in terms of the Besselian elements, we have;

$$\xi = \rho \cos \phi' \sin H$$

$$\eta = \rho \sin \phi' \cos d - \rho \cos \phi' \sin d \cos H$$

$$\zeta = \rho \sin \phi' \sin d + \rho \cos \phi' \cos d \cos H$$

and their variations per minute as :

$$\xi' = \mu' \rho \cos \phi' \cos H$$

$$\eta' = \mu' \xi \sin d - \zeta d'$$

where $H = \mu + \lambda$ and μ' is variation per minute in hour angle. In most of the cases, the variation ζ' is not needed and may be neglected. The values of $\rho \cos \phi'$ and $\rho \sin \phi'$ used above may be found for the observer's latitude ϕ using Table – XI.

The eclipse begins or ends at the station when $(x - \xi)^2 + (y - \eta)^2 = (l_1 - \zeta \tan f_1)^2$.

Now let $m \sin M = x - \xi$, $m \cos M = y - \eta$ so that $\tan M = (x - \xi)/(y - \eta)$ and $m^2 = (x - \xi)^2 + (y - \eta)^2$. The angle M may have any value from 0° to 360° and m is always positive.

Again let $n \sin N = x' - \xi'$, $n \cos N = y' - \eta'$ so that $\tan N = (x' - \xi')/(y' - \eta')$ and $n^2 = (x' - \xi')^2 + (y' - \eta')^2$. The angle N is in the first two quadrants and n is positive.

The radius of the shadow at a height ζ above the fundamental plane may be determined by $L_1 = l_1 - \zeta \tan f_1$ or $L_2 = l_2 - \zeta \tan f_2$ as the case may be.

Now the required time of the event will be obtained by applying a correction τ to the adopted initial time concerned, given by

$$\tau = -\{m \cos (M - N)\}/n + (L \cos \psi)/n \quad \text{(in minutes)}, \quad \text{where } \sin \psi = \{m \sin (M - N)\}/L$$

The value of ψ for which $\cos \psi$ is negative should be taken for the beginning of the eclipse for the beginning of the annular phase or the end of the total phase, and the value of ψ for which $\cos \psi$ is positive is to be taken for the end of the eclipse, for the end of the annular phase or the beginning of the total phase. When $M - N$ falls within 0º to 180º, ψ is in the 2nd or the 1st quadrant according to the required phase of the eclipse, for the other half it is in the 3rd or the 4th quadrant according to the phase.

If the correction τ obtained above exceeds 3 or 4 minutes and greater accuracy is desired, the computation should be repeated using the new times now obtained as initial times.

For finding the time of greatest phase , the calculations should be started adopting a new assumed time midway between the beginning and ending times. The correction to this adopted time is given by:

$$\tau = -\{m \cos (M - N)\}/n \text{ (in minutes)}.$$

EXPLANATION

The magnitude of greatest partial eclipse is the fraction of the Sun's diameter obscured by the Moon at the time of greatest phase, and is given by : $M_1 = (L_1 - \Delta) / (2 L_1 - 0.5459)$ where Δ, the minimum distance between the centres of the two bodies, is given by $m \sin (M - N)$ and is to be taken positive.

The magnitude of the central phase, in the same units, is $M_2 = (0.5459) / (2 L_1 - 0.5459)$.

The position angle of the point of contact measured from the north point of the Sun in the direction N. E. S. W. (i.e. clockwise direction) may be obtained from $P = N + \psi$ or if, measured from the vertex, from $V = P - C$ where C, the parallactic angle, is given by $\tan C = (\xi / \eta)$.

Occultations

The occultations of visible planets and certain bright stars (*Aldebaran , Regulas, Spica and Antares)* by the Moon are given whenever they occur, together with the time, area of visibility and the Besselian elements. The area of visibility includes also the regions from which the occultations is visible even during day light hours. The two times given in the first table for the occultations are the times of first and last contact of the shadow cylinder with the Earth and as such the occultation may be expected to be visible only within the period between these times.

The elements are similar to those for solar eclipses and are given for T_0, the instant of conjunction in R.A. when x = 0. The common geocentric hour angle of the bodies, or more precisely of the line passing through the center of the Earth parallel to the line joining the center of the two bodies for the Greenwich meridians is H_0 and its hourly variation is about $60^m.16$ or $15^o.04$. Y is the value of y for the instant of conjunction and x', y' are the hourly variations of x and y. For a place where an occultation is visible, the times of immersion and emersion can be computed with the help of these elements by a method similar to that used in computing the local circumstances of a solar eclipse as explained below:

Let φ and λ be respectively the latitude and longitude of the place. The longitude of place is to be taken in hours and minutes and as usual measured positively towards east of Greenwich.

For night visibility of an occultation, the necessary conditions are as follows:

(1) The Sun must not be much more than an hour above the horizon at the local mean time $T_0 + \lambda$ (and it must be below the horizon at time $T_0 + \lambda + t$).

(2) The Moon must be above the horizon by an appreciable amount, i.e., the quantity $H_0 + \lambda$, taken without regard to sign for this purpose, must be less than the semidiurnal are of the star of planet by at least one hour.

For prediction of an occultation, find the approximate time (U.T.) of local apparent connection by applying to the given T_0 a correction t (in hours) taken from the following table*:

$H_0 + \lambda$

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
φ	0-00	0-30	1-00	1-30	2-00	2-30	3-00	3-30	4-00	4-30	5-00	5-30	6-00
	h	h	h	h	h	h	h	h	h	h	h	h	h
0°	0.00	0.41	0.77	1.08	1.32	1.50	1.62	1.69	1.72	1.73	1.71	1.65	1.58
10°	0.00	0.40	0.75	1.06	1.29	1.47	1.59	1.66	1.70	1.70	1.69	1.63	1.56
20°	0.00	0.37	0.70	0.99	1.21	1.38	1.51	1.58	1.62	1.63	1.61	1.56	1.50
30°	0.00	0.32	0.62	0.87	1.08	1.24	1.36	1.44	1.49	1.50	1.50	1.45	1.40
40°	0.00	0.26	0.51	0.73	0.92	1.07	1.18	1.26	1.30	1.32	1.32	1.30	1.26
50°	0.00	0.20	0.40	0.58	0.73	0.86	0.96	1.03	1.08	1.11	1.11	1.10	1.07
60°	0.00	0.15	0.29	0.42	0.53	0.63	0.72	0.78	0.83	0.85	0.87	0.86	0.85

*The value of t has the same sign as that of $\sin (H_0 + \lambda)$.

The Besselian elements x and y at the time of local conjunctions $T_0 + t$ may be calculated as follows :

$x = x' t,$ and $y = Y + y' t.$

EXPLANATION

Occultations for which $y - \eta$ for the time local conjunction is not within ± 0.35 will not be visible at the place. In order to decide this, an estimated value of η may be used as an approximation for which the following tables are given indicating the minimum and maximum values of η.

Limiting value of η *(when on meridian i.e., when* $H_0 + \lambda = 0$ *)*

φ - d ………	0°	10°	20°	30°	40°	50°	60°
η ………	0.00	0.17	0.34	0.50	0.64	0.76	0.86

The values of η has the same sign as that of φ - d.

(* The table has been constructed taking $x' = 0.5773$; for other values of x' the figures will vary inversely. For this purpose the figures of the table may be multiplied by 1.15 for $x' = 0.50$, by 1.05 for $x' = 0.55$, by 0.95 or $x' = 0.60$ and by 0.89 for $x' = 0.65$)

Limiting value of η *(when rising or setting i.e. when* $H_0 + \lambda + t$ *= S.D. arc)*

	Latitude (φ)						
d	0°	10°	20°	30°	40°	50°	60°
0°	0.00	0.17	0.34	0.50	0.64	0.76	0.86
± 9	0.00	0.17	0.34	0.50	0.65	0.77	0.87
± 18	0.00	0.18	0.36	0.52	0.67	0.80	0.91
± 27	0.00	0.19	0.38	0.56	0.72	0.86	0.97

The value of η has the same sign that of φ

For the instant $T_0 + t$, compute the following quantities in addition to x and y :

Let H = (H + λ) + $a\,t$ (converted into arc). The value of a has been given for planets under elements; it is 1.027 for stars. The observer's position on the fundamental plane is given by:

$$\xi = \rho \cos\varphi' \sin H \text{ and } \eta = \rho \sin\varphi' \cos d - \rho \cos\varphi' \sin d \cos H$$

and the hourly variations ;

$$\xi' = 0.2618\, a\, \rho \cos\varphi' \cos H,\ \ \eta' = 0.2618\, a\, \xi \sin d.$$

The value of the co-efficient 0.2618 a is 0.2625 for stars.

Let $u = x - \xi$, $v = y - \eta$, $u' = x' - \xi'$, $v' = y' - \eta'$ so that $n^2 = u'^2 + v'^2$.

Now sin $\psi = (uv' - vu') / nl$, where l = 0.2725, for stars, and for planets, it will be found under elements.

The correction τ to the time of immersion and emersion is given by :

$$\tau = -(60/n^2)(uu' + vv') \mp (60\, l / n) \cos \psi$$

The negative sign in the second term is to be taken for immersion or the first contact and the positive sign for emersion or the last contact.

Instant of immersion or emersion = $T_0 + t + \tau$.

If greater accuracy is desired, a second set of calculations may be done in the following way using the new times now obtained as initial times. For the revised time of immersion or emersion T, compute H = (H + $\lambda + at$) + $a\tau$, $x, y, \xi, \eta, \xi', \eta'$; u, v, u', v' and D = $uu' + vv'$. The second correction t′ is given by : $t' = (30/D) \times [l^2 - (u^2 + v^2)]$ in mins. of time.

The final time of immersion or emersion = $T + t'$.

The angles of contact on the Moon's limb:

EXPLANATION

$P = M + 180°$, where $\tan M = (u + u't') / (v + v't')$,

$V = P - C$, where $\tan C = (\xi + \xi' t') / (\eta + \eta' t')$,

where t′ is to be taken in hours.

PART V – Miscellaneous Tables

Phenomena

The stellar magnitudes of planets together with their elongations from the Sun have been given under ‘phenomena’ at suitable intervals of days. The computation in the next portion of the phenomena has been based on longitude and that in the Astronomical Diary mainly on right ascension, with the exception that the conjunctions, squares and oppositions of planets with the Sun included in the latter have been calculated on the basis of longitudes. In the case of conjunctions in right ascension, the differences in declination between the planets or the Moon and the planet have also been given. The dates of heliacal visibility of planets (Mercury to Saturn) have also been given and these are based on the method given on page 475.

Interpolation

Interpolation Coefficients have been given on pages 363 to 366 according to the formula of both Bessel and Everett, for each hundredth part of the time-interval.

Let the tabular value of a function given at equal intervals be represented by f and the first and second differences by Δ with relevant dashes and subscripts as shown below. It is required to determine the value of the function at some intermediate point.

Function	First difference	Second difference
f_{-1}		
	$\Delta'_{-½}$	
f_0		Δ''_0
	$\Delta'_{½}$	
f_1		Δ''_1
	$\Delta'_{1½}$	
f_2		

The epochs for which the values of the function are to be taken should be so chosen that the time for which the value of the function is required may fall within the interval f_0 and f_2 and let n be the time interval from f_0 up to the moment for which the value of the function is required. It is expressed as a fraction of the interval at which the given values of the function are tabulated. Let f_n be the value of the function for the desired time which is now required to be determined.

The two formulae for interpolation which are generally used for the purpose are as follows :

$f_n = f_0 + n\,\Delta'_{½} + B''(\Delta''_0 + \Delta''_1)$…………………Bessel

$f_n = f_0 + n\,\Delta'_{½} + E_0''\Delta''_0 + E_1''\Delta''_1$………………Everett

in which $f_0 + n\Delta'_{½}$ may be replaced by $(1-n) f_0 + nf_1$, if necessary, and where

$$B'' = n\,(n-1)/ 4,\ \ E_0'' = -\,n\,(n-1)\,(n-2)/ 6 \text{ and } E_1'' = n\,(n+1)\,(n-1)/ 6$$

It will be noted that in Bessel’s formula the value of $\Delta''_0 + \Delta''_1$ is the same as $\Delta'_{1½} - \Delta'_{-½}$. The value of the coefficients B'', E_0'' and E_1'', all of which are negative within the range f_0 to f_1 , will be obtained from the table on page 363 to 366 for the given value of n.

EXPLANATION

Bessel's method of interpolation is more simple, but greater accuracy is yielded by Everett's formula on account of the fact that it includes the effect of third differences also.

The more complete formula of Bessel is as follows :

$$f_n = f_0 + n\Delta'_{½} + \{n(n-1)(\Delta''_0 + \Delta''_1)\}/4 + \{n(n-1)(n-½)\Delta'''_{½}\}/6 + \cdots\cdots$$

The rate of variation of the function at a point, i.e., the instantaneous motion per unit of time interval may be obtained by the following formula :

Motion = $\Delta'_{½} + C\Delta_0'' + D\Delta_1''$, where $C = -(3n^2 - 6n + 2)/6$ and $D = (3n^2 - 1)/6$

When $n = 0$, the motion $f_0' = \{(\Delta'_{-½} + \Delta'_{½})/2\} - (\Delta_1'' - \Delta_0'')/6$,
when $n = ½$, $f'_{½} = \Delta'_{½} - \{(\Delta_1'' - \Delta_0'')/24\}$ and when $n = 1$, $f_1' = \{(\Delta'_{½} + \Delta'_{1½})/2\} - (\Delta_1'' - \Delta_0'')/6$

The stationary point (i.e., when $f' = 0$) occurs when $n = ½ - (\Delta'_{½}/\Delta''_1)$ or $½ - (\Delta'_{-½}/\Delta''_0)$.

Geocentric Co-ordinates and other Constants

The tables given on pages 371 and 372are for computing the geocentric co-ordinates of a place for which the geodetic, i.e., geographic or common latitude φ is known. From the first table, the values of ρ sin φ′ and ρ cos φ′ can be directly obtained, while the second table gives the values of the geocentric latitude φ′ and the radius of the Earth ρ separately

The constants used for these tables and the others given below are the 1976 I.A.U. System of astronomical constants introduced in this publication with effect from the 1985 issue.

Equatorial radius (a) = 637 8140 m = 3963.20 miles.
Polar radius (b) = 635 6755 m = 3949.91 miles.
Flattening of the Earth (f) = (a-b)/a = 1/298.257 = 0.003 353 64.
Ellipticity or eccentricity (e) = 0.081 8192, e^2 = 0.006 694 39.

The following expressions are obtained from the above values of flattening and radius of the Earth.

$S = 0.994\,9743 - 0.001\,6708 \cos 2\varphi + 0.000\,0021 \cos 4\varphi$

$C = 1.001\,6799 - 0.001\,6820 \cos 2\varphi + 0.000\,0021 \cos 4\varphi$

$\rho = 0.998\,3271 + 0.001\,6764 \cos 2\varphi - 0.000\,0035 \cos 4\varphi$

$\varphi' = \varphi - 11' 32''.726 \sin 2\varphi + 1''.163 \sin 4\varphi - 0''.003 \sin 6\varphi$

One degree of longitude (in km.) = 111.4133 cos φ - 0.0935 cos 3 φ

One degree of latitude (in km.) = 111.1334 – 0.5598 cos 2 φ + 0.0012 cos 4 φ

g (cm/sec²) = 978.031 + 5.1859 sin² φ - 0.0057 sin² 2 φ - 0.000 308H. where H is the elevation in meters above sea level.

Period of Earth satellite of negligible mass = 84.489 09 $d^{3/2}$ mins., where d is the mean distance of the satellite from the Earth's center measured in units of 6378140 m (Earth's equatorial radius).

Invariable plane of the solar system; $\Omega = 106°35' 01'' + 3452''T$, $I = 1° 34' 59'' - 18''T$

Pole of galactic plane (1950); $\alpha = 12^h 49^m.0$, $\delta = +27° 24'$

Solar apex (1950).. $\alpha = 18^h 06^m$, $\delta = +30°$

Solar motion = 20.0 km. or 12.4 miles per sec.

Speed of the Earth moving around the Sun = 29.79 km. or 18.51 miles per sec.

EXPLANATION

Heliacal Rising and Setting of Planets

The planets Mercury to Saturn (as well as the Moon) remain invisible to the naked eyes for some days at the time of conjunction with the Sun. This phenomenon of planet's invisibility due to its proximity to the Sun is known as combust or heliacal setting of the planets, and it plays an important part in Indian Calendar. The dates of heliacal setting and rising of the planets marking the period or invisibility have been calculated assuming that the phenomenon occurs when, at the given station, the Sun attains a Zenith distance of $90°+h$ at the time when the zenith distance of the planet is 90°. The values of h for different planets adopted for the purpose are as follows :

Mercury 10° (Direct) and 11° (Retrograde)
Venus 6°, Mars 14,° Jupiter 8°.5 , and Saturn 12°

The day of the first visibility of the lunar crescent after a new-moon day has also been determined in a somewhat similar way on the basis of the following values of the limiting altitude of the Moon above the horizon corresponding to its azimuth difference from the Sun, when the zenith distance of the Sun is 90°.

Azimuth difference	0°	5°	10°	15°	20°
Altitude	10°.4	10°.0	9°.3	8°.0	6°.2

When the altitude of the Moon at sunset exceeds the above limit, the Moon is likely to be visible in that evening and when the excess is more than a degree, the Moon is sure to be visible. The beginning dates of the months of the Islamic Calendar have been determined on the basis of the above calculations and indicated on the date following that of the first visibility of the Moon.

In the above calculations, the atmospheric refraction and the horizontal parallax of the Moon are neglected.

The computations of heliacal rising and setting of planets and determination of the dates of first visibility of the Moon have been done for the central station of India.

ASTRONOMICAL CONSTANTS*

Units : The units meter (m), kilogram (kg.) and second (s) are the units of length, mass and time in the International System of Unit (SI).

The astronomical unit of time is a time interval of one (*D*) of 86400 seconds. An interval of 36525 days is one Julian century.

The astronomical unit of mass is the mass of the Sun (*S*).

The astronomical unit of length is that length (*A*) for which the Gaussian gravitational constant (*k*) takes the value of 0.01720209895 when the units of measurement are the astronomical unit of length, mass and time. The dimensions of k^2 are those of the constant of gravitational (*G*), i.e. $L^3M^{-1}T^{-2}$. The term "unit distance" is also used for the length *A*.

Defining Constants :

1. Gaussian gravitational constant — $k = 0.017\ 202\ 098\ 95$
2. Speed of light — $c = 299\ 792\ 458\ ms^{-1}$

EXPLANATION

Primary Constants :

3.	Light-time for unit distance	τ_A = 499.004 78384 s
4.	Equatorial radius for Earth	a_e = 637 8136.6 m
	[IUGG value	a_e = 637 8137 m]
5.	Dynamical form-factor for Earth	J_2 = 0.001 082 6359
6.	Geocentric gravitational constant	$GE = 3.986\ 004\ 418 \times 10^{14}\ m^3\ s^{-2}$
7.	Constant of Gravitation	$G = 6.674\ 28 \times 10^{-11}\ m^3\ kg^{-1}\ s^{-2}$
8.	Ratio of mass of Moon to that of Earth	μ = 0.012 300 0371
9.	General precession in longitude, per Julian century, at standard epoch J 2000.0	P = 5028".796195
10.	Obliquity of the ecliptic, at standard epoch J2000.0	ε = 23º 26' 21".406

Derived Constants

11.	Constant of nutation at standard epoch J2000.0	N = 9".2052 331
12.	Unit distance	$c\tau_A = A = 1.495\ 978\ 707 \times 10^{11}$m
13.	Solar parallax	arc sin $(a_e/A) = \pi\odot$ = 8".794143
14.	Constant of aberration for standard Epoch J2000.0	k = 20".49551
15.	Flattening factor for the Earth	f = 0.003 352 82 = 1/298.25642
16.	Heliocentric gravitational constant	$A^3\ k^2/D^2 = GS = 1.327\ 124\ 42099 \times 10^{20}\ m^3\ s^{-2}$
17.	Ratio of mass of Sun to that of the Earth	$(GS)/(GE) = S/E$ = 332 946.0487
18.	Ratio of mass of Sun to that of Earth + Moon	$(S/E)/(1+\mu)$ = 328 900.5596
19.	Mass of the Sun	$(GS)/G = S = 1.9884 \times 10^{30}$ kg
20.	System of planetary masses : (Ratios of mass of Sun to those of the planets etc.)	

Mercury	6023600	Jupiter	1047.348644
Venus	408523.719	Saturn	3497.9018
Earth + Moon	328900.5596	Uranus	22902.98
Mars	3098703.59	Neptune	19412.26
		Pluto	136566000

Other quantities for use in the preparation of ephemerides :

It is recommended that the values given in the following list should normally be used in the preparation of new ephemerides.

21. Masses of minor planets in unit of the solar mass :

(1) Ceres	4.72×10^{-10}
(2) Pallas	1.03×10^{-10}
(3) Vesta	1.35×10^{-10}

- -

*See page 454 also for some of the constants actually used in preparation of the ephemerides reported in the publication.

EXPLANATION

22. Masses of satellites in unit of the planet's mass :

Jupiter	Io	4.704×10^{-5}
	Europa	2.528×10^{-5}
	Ganymede	7.805×10^{-5}
	Callisto	5.667×10^{-5}
Saturn	Titan	2.366×10^{-4}
Neptune	Triton	2.089×10^{-4}

23. Equatorial radii in km.

Mercury	2439.7	Jupiter	71492	Pluto	1195
Venus	6051.8	Saturn	60268		
Earth	6378.1366	Uranus	25559	Moon	1737.4
Mars	3396.19	Neptune	24764	Sun	696000

24. Gravity fields of the planets.

	J_2	J_3	J_4
Earth	$+\ 1.08263 \times 10^{-3}$	$-\ 2.54 \times 10^{-6}$	$-\ 1.61 \times 10^{-6}$
Mars	$+\ 1.964 \times 10^{-3}$	$+\ 36 \times 10^{-6}$	
Jupiter	$+\ 14.75 \times 10^{-3}$		$-\ 580 \times 10^{-6}$
Saturn	$+\ 16.45 \times 10^{-3}$		$-\ 1000 \times 10^{-6}$
Uranus	$+\ 12 \times 10^{-3}$		
Neptune	$+\ 4 \times 10^{-3}$		

25. Gravity field of the Moon.

$\gamma = (B-A)/C = 0.000\,2278$		$C/MR^2 = 0''.392$
$\beta = (C-B)/B = 0.000\,6313$		$I = 5552''.7 = 1^\circ\ 32'\ 32.7''$
$C_{20} = -\ 0.000\,2027$	$C_{30} = -\ 0.000\,006$	$C_{32} = +\ 0.000\,0048$
$C_{22} = +\ 0.000\,0223$	$C_{31} = +\ 0.000\,029$	$S_{32} = +\ 0.000\,0017$
	$S_{31} = +\ 0.000\,004$	$C_{33} = +\ 0.000\,0018$
		$S_{33} = -\ 0.000\,001$

REFERENCES

1. Anderson, J. D. 1974. *EOS Trans. of AGU 55.*
2. Anderson, J. D. 1975 *Review of Geophysics and Space Physics 13.*
3. Anderson, J. D., Null, G. W., Wong, S. K. 1974. *J. Geophys. Res*. 79, 3661.
4. Aoki, S., Guinot, B., Kaplan, G. H., Kinoshita, H., McCarthy, D. D., Seidelmann, P. K. 1982. *Astron. Astrophys., 105, 359.*
5. Aoki, S., Soma. M., Kinoshita, H., Inoue, K. 1983. *Astron. Astrophys. 128*, 263-267.
6. Capitaine, N., P. T. Wallace, J. Chapront, 2003. *Astronomy and Astrophysics 412*, 567-586
7. Capitaine, N., P. T. Wallace, J. Chapront, 2005. *Astronomy and Astrophysics 432*, 355-367
8. Clemence, G. M., Szebehely, V. 1967. *Astron. J. 72*, 1324.
9. Davies, M. E., Abalakin, V. K., Cross, C. A., Duncombe, R. L., Masursky, H., Morando, B., Owen, T. C., Seidelmann, P. K., Sinclair, A. T., Wilkins, G. A., Tjuflin, Y. S. 1980 *Celest. Mech. 22, 205.*
10. Duncombe, R. L., Klepczynski, W.J., Seidelmann, P. K. 1973, *Fundamentals of Cosmic Physics 1*, 119.
11. Duncombe, R. L., Seidelmann, P. K., Janiczek, P. M. 1974. *Highlights of Astronomy 3*, 223
12. Eckhardt, D. H. 1973. *The Moon 6*, 127.
13. *Explanatory Supplement to the Ephemeris*, 1974. Her Majesty's Stationery Office, London, 48 and 144.
14. *Explanatory Supplement to the Astronomical Almanac,* 1992. Nautical Almanac Office, U. S. Naval Observatory
15. Fricke, W. 1967. *Astron. J. 72*, 1368.
16. Fricke, W. 1971. *Astron. Astrophys. 13,* 298.
17. Fricke, W. 1977. *Astron. Astrophys. 54,* 363.
18. Fricke, W. 1981. in *Reference Co-ordinate System for Earth Dynamics*, E. M. Gaposchkin and B.
19. Kolaczek, eds., D. Reidel Publishing Company, 331.
20. Fricke, W. 1982. *Astron. And Astrophys. 107.* L13-L16.
21. Harrington, R. S., Christy, J. W. 1980. *Astron, J. 85*, 168.
22. Hertz, H. G. 1968. *Science 160*, 299.
23. Howard, H. T., Tyler, G. L., Esposito, P. B., Anderson, J. D., Reasenberg, R. D., Shapiro, I. I., Fjeldbo,
24. G., Kliore, A. J., *et al*. 1974. *Science 185*, 179.
25. IAG Geodetic Reference System 1967. 1971. IAG *Spec. Pub. No. 3 Bulletin Geodesique*.
26. IAG Sixteenth General Assembly (1975) proceedings, 1975. *Bulletin Geodesique 118*. 365.
27. IAU Twelfth General Assembly (1964) proceedings, 1966. *Trans. IAU XII B*, 116.
28. IAU Fifteenth General Assembly (1973) proceedings, 1974. *Trans IAU XV B, 108.*
29. IAU Sixteenth General Assembly (1976) proceedings, 1977. *Trans. IAU XVI B*, 58.
30. IAU Seventeenth General Assembly (1979) proceedings, 1980. *Trans. IAU XVII B*, 69.
31. IAU Eighteenth General Assembly (1982) proceedings, 1983. *Trans. IAU XVIII B*.
32. IAU Twenty-first General Assembly (1991) proceedings, 1992. *Trans. IAU XXI B*.
33. IAU Twenty-third General Assembly (1997) proceedings, 1999. *Trans. IAU XXIII B*.
34. IAU Twenty-fourth General Assembly (2000) proceedings, 2001. *Trans. IAU XXIV B*.
35. IAU Twenty-sixth General Assembly (2006) proceedings, 2006. *Trans. IAU XXVI B*.
36. IERS *Technical Note 32*, 2004.

REFERENCES

37. IERS *Technical Note 35*, 2009.
38. IERS *Technical Note 36*, 2010.
39. Kaplan, G. H. 1981. *U. S. Naval Observatory Circular No. 163.*
40. Kaplan, G. H. 2005. *U. S. Naval Observatory Circular No. 179.*
41. Kinoshita, H. 1977. *Celest. Mech. 15*, 277.
42. Lieske, J. H. 1979. *Astron. Astrophys. 73*, 282.
43. Lieske, J. H., Lederle, T., Fricke, W., Morando, B. 1977. *Astron. Astrophys. 58,* 1 .
44. Liu, A. A., Laing. P. A. 1971. *Science 173*, 1017.
45. Misner, C. W., Thorne, K. S., Wheeler, J. A.1973. Gravitation, W. H. Freeman and Company, 184 and 1101.
46. Moritz, H. 1980. *Bulletin Geodesique 54*, 395.
47. Moyer, T. 1981. *Celest. Mech. 23*, 33 & 57.
48. Null, G. W., Anderson, J. D., Wong, S. K. 1975. *Science 188*, 476.
49. Schubart, J. 1974. *Astron. Astrophys. 30*, 289.
50. Schubart, J. 1975. *Astron. Astrophys. 39*, 147.
51. Scott, F. P. 1964. *Astron. J. 69*, 372.
52. Scott, F. P., Hughes, J. A. 1964. *Astron. J. 69*, 368.
53. Seidelmann, P. K. 1982, (1980). *Celest. Mech. 27*, 79-106.
54. Seidelmann, P. K., Kaplan, G. H., Van Flandern, T. C. 1981. In *Reference Co-ordinate system for*
55. *Earth Dynamics*, E. M. Gaposchkin and B. Kolaczek, eds., D. Reida Publishing Company, 305.
56. Sjogren, W. L. 1971. J. *Geophys. Res. 76*, 7021.
57. Van Flandern, T. C. 1971. *Celest. Mech. 4*, 182.
58. Van Flandern, T. C. 1981. Preprint, submitted to *Astron. J.*
59. Wade, C. M. 1976. *VLA Scientific Memorandum 122*.
60. Wahr, J. 1979. Ph. D. Thesis, University of Colorado.
61. Wahr, J. 1981. *Geophys. J. Roy. Astr. Soc. 64*, 705.
62. Williams, J. 1975. *EOS Trans. Of AGU 56*, 236.
63. Winkler, G. M. R., Van Flandern, T. C. 1977. *Astron. J. 82,* 84.
64. Standish, E. M. 1982. *Astron. Astrophys. 115,* 20-22.

INDEX

INDEX

INDEX